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Vol. VI. NEW YORK, DECEMBER 5, 1885. No. 23.

MENTION is made in another paragraph of an application to this paper from Russia, for information. This is in itself evidence of wide circulation and reputation, but we have other evidence this week in the shape of a patent case from Norway and another from China. Yet additional proof is given in a commuication from England to M. Hospitalier, addressed to this office.

THAT is a very poetical plan by which the President of the United States, standing in Washington, on May 1 next, is to open the American Exhibition in London, England, merely by touching a button. President Arthur, in Washington, started the machinery in the World's Fair at New Orleans in a similar manner, but there is something startling in the contemplation of the vast distance, over land and sea—three thousand miles through "the dark unfathom'd caves of ocean." The famous "cannon-shot," already written of figuratively, but not yet fired and "heard around the world," is not more marvelous.

WE have received this week from the municipality of Moscow, Russia, a letter asking us to furnish the authorities with information respecting the city lighting in this country by means of central stations. It appears that it is proposed to light Moscow by electricity, and to furnish power from the same station. It may be worth the while of our American companies to get the contract for this big piece of work abroad.

THE delicacy of the telephone, so well known and so frequently commented on in the past, has received another striking illustration in the remarkable results obtained in its use in telegraphy for moving trains. By its extraordinary sensitiveness the insulation of the line, which had heretofore been considered as a prime essential, is made of secondary importance, so that the practical advantage in the use of this delicate current indicator is brought out in a notable manner. Mr. Phelps has already shown remarkable ingenuity in the application of his system, and this added and decided advantage to it must undoubtedly tend to its rapid introduction.

ON NOV. 26 the memory of Sir William Siemens was honored by the unveiling of a memorial window in Westminster Abbey, on the second anniversary of the funeral service in the Abbey. Although not a son of England by birth, Siemens' illustrious career was begun and finished on her soil, and it is but fitting that the great repository of her heroes and geniuses should hold a mark to his memory. Siemens was not only one of the chief developers of the dynamo and its application in England, but his other inventions in the domain of the application of heat have been the source of incalculable saving in fuel not only to his adopted country, but to the whole world.

SUCH is the fascination which electricity exerts upon the minds of some young people, that in their enthusiasm they are often carried away completely. A sad instance of this is shown in the case of a boy of sixteen who stole a small electric motor exhibited at the London Inventions. When he was arraigned before the judge his mother pleaded that he was passionately fond of experiments in electricity, and that this was the reason of his crime. The judge took another view of the case, and required bail for his future good behavior. Luckily the average "small boy" is not so fond of "experiments in electricity" as the specimen described above, so that we may still hope to find our incandescent lamps in the sockets in which we leave them when we take a walk abroad.

IN an article in another column a civil engineer remarks that numerous German workmen find employment in English electric lighting stations and in electrical works generally. He seeks the cause for this in the fact that Germany presents greater advantages for technical education than England, hence the superiority of Germans in this line. To a certain extent experience here is the same. There can be no denying the fact that Germany is well represented in our electrical workshops and laboratories; but the time is not far distant when the "home supply" of capable men will be equal to the demand. The increasing number of our technical schools, and the enlarging scope of those already existing, must eventually place us on a level with the best of other countries as regards technical education.

MR. JAY GOULD is again credited with the intention to retire from active business. In this respect he is not unlike the popular prima donna and the star actor, whose "positively last appearance" is announced regularly every year. One cannot say of Mr. Gould that "he never would be missed," but there are many who would endeavor to regard his retirement in the true spirit of resignation, as illustrated by Mark Tapley. It is not easy to know just what a millionaire means by "withdrawal from active business." It is but a year ago that Mr. Cyrus Field bade farewell to the scenes he had so long adorned and brightened in the financial world, but to-day we see him in a frenzy of indignation at the conduct of the Governor of Massachusetts, who omitted to accept his tender for some bonds. There are many elements in both Mr. Gould and Mr. Field that have our warm admiration, but we must confess that it is almost as hard to believe what they say about themselves as what others say about them, especially in this little respect of retiring from business.

THE increase in the number of telephones issued this year and last, as shown by figures quoted in this issue, is rather small, and would be sufficient in itself to account for the prevailing low prices of Bell stock, even were there no other reasons. It is, however, more difficult to say what accounts for the falling off in the output of instruments. The troubles over telephone rates in New England may be answerable for a part of the decline, but only for a small part, and that only during the close of the eleven months treated. It may be that the efforts of the opposition companies in some quarters have done harm, but it is not very serious, after all. Perhaps the business stagnation of the past year will explain the matter to a great extent, and it is also probable that the increase in the telephone business will not come now by leaps and bounds, but be subject to a law of steady, average growth. One thing is certain: there has been growth in spite of all influences to the contrary, and the telephone is more than ever a necessity of social and commercial life.

LEAVING aside all sentiment and the praise due to M. Deprez for the perseverance and skill he exhibits in the conduct of his work, the conclusion forces itself upon us that his experiments cannot lead to a practical issue. That power can be transmitted electrically is not a new fact, and the question of *economy* seems to be a secondary matter to M. Deprez, whereas in practice it is the prime question. He has built a long line and machines to transmit one hundred horse-power, the cost of which far exceeds that of an equivalent steam-power plant, and still hopes to make a good showing. He has even now probably reached as high a limit of electromotive force as he dare employ on the circuit, so that an increase of power means a larger conductor, and, consequently, still greater expense. The problem of long-distance transmission appears to us, therefore, as being as far as ever from a practical solution, and the difficulties encountered are still unremoved. For economical transmission to long distances high electromotive force is undoubtedly necessary, but a limit is soon reached in this respect, beyond which it becomes materially impossible to transmit large powers. The problem may be likened in this regard to that of the boiler and steam-engine. We all know that higher steam pressures than are now used, say 500 or 1,000 lbs. to the square inch, would lead to greater economy, yet their use is materially impossible or rather impracticable, as the cost of boilers and engines to utilize such pressures would be enormous, and no ordinary working joint could withstand them. To return to the electrical part, even with the 6,000 volts employed by M. Deprez, extraordinary precautions have to be taken in insulating the dynamo, and the line being exposed to rough weather influences and accidents, it seems hardly probable that it could long withstand the enormous electrical "pressure" put upon it. As yet M. Deprez has only tried one generator in connection with one receiver, so that the question of the *distribution* of power transmitted from long distances is still to be attacked. He proposes to try two receiving machines shortly, but it can almost be settled as a foregone conclusion that he will not obtain the same efficiency as in his first trial with one machine. From a scientific standpoint M. Deprez's experiments are of value, but although we are ever ready to herald an advance in the application of electricity, we can hardly see our way clear to an admission of the *practical* value of M. Deprez's experiments.

IN one of our English contemporaries a writer, in an article designed apparently to show that there is absolutely nothing new under the sun in the electric lighting field, refers particularly to the developments of electricity from this country and in the following strong language: "Some ill-disposed persons who have a prejudice against all things not cockneyfied have gone so far as to say that the keen Yankee, in the time of the electrical boom, hunted out old patents, repatented their contents and sold his work for a goodly sum. We have often stated that only a small percentage of patents issued by the Patent Office contained new ideas. Yet we did not imagine that plagiarism in patents was quite so bad as it is till after a long investigation. There can be hardly a doubt, however, but that some American patents are deliberate copies of prior English patents." This plagiarism of patents which the alarmist inveighs against may exist in some cases, but he must make a distinction between a direct copy and an improvement. The Yankee, as well as the Cockney, has a perfect right to take up an existing invention and so to alter and improve it that it will be more efficient than before. This is perfectly legitimate, and indeed 99 out of every 100 patents issued at present, anywhere in the world, are for improvements on existing devices rather than original, fundamental inventions. The article evidently casts a slur upon the efficiency of the United States Patent Office. It is true that the latter is sometimes taxed with a careless disregard of previous inventions, and in the case with which it issues patents for absurd ideas; but we think that in this respect it yields precedence to the English office. A patent has just been issued to a "mercantile clerk," who lives near London, on an invention for getting gold by a method of boiling and baking from wheat. He is neither a baker nor a farmer, as that description might imply, but actually proposes to "cut up the whole wheat straw into little square snips the width of the straw, and mix this with an equal measure of the grains." He then boils this mixture, strains off the liquor into soup plates, bakes the plates slowly dry, and then finds the gold adhering to the plates. We do not think that Uncle Sam would go so far as to take the government patent fee on a case like that, for the "invention" is evidently visionary. Englishmen especially ought to speak guardedly of patents and patent rights, for, as is well known, their system leaves a great many loopholes for dishonest applicants. Right-minded Yankees and Englishmen have pretty much the same ideas on these subjects, however, and know it is easier to find faults than remedies for them.

Accumulator-Electrodes.*

BY EMILE REYNIER.

Although strongly attacked by certain electricians, the new chemical theory of accumulators which I have put forward in this journal, is at present generally accepted. No objection, based upon experiment, has been urged against it; on the contrary, facts daily testify in its favor. Thus, MM. Crova and Garbe have experimentally proved the fixation of one equivalent of sulphuric acid upon each electrode during the discharge, and M. Tscheltgow, after having measured the formation heat of the peroxide of lead, has furnished the new theory with a thermo-chemical verification which had already been foreseen.

It is known that I did not wait for these late confirma-

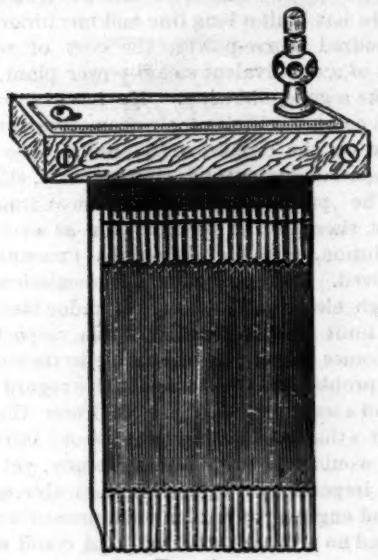


FIG. 1.

tions to admit double sulphatation in the solution of the problems raised by the rational construction of electric accumulators. The new chemical theory has also given me the means of calculating the increase in the bulk of the electrodes by *formation* and by discharge, phenomena which I have designated by the name of *increases*.

The study of increases finds, in turn, its practical application in the manufacture of folded accumulator plates. These expansions, which were formerly injurious, will in future improve and accelerate the formation of the plates.

My old folded accumulators, Fig. 1, if the formation was carried too far, took a fan-shaped development, Fig. 2, which was clumsy and inconvenient; the electro-chemical capacity of the accumulator was far from increasing in proportion to the quantities of increased matter, a proof that these substances took little part in the reactions of the discharge.

I thought that by limiting the lateral expansion I should produce an energetic compression of the superficial dust against the inner sides of the folds, and that these sub-

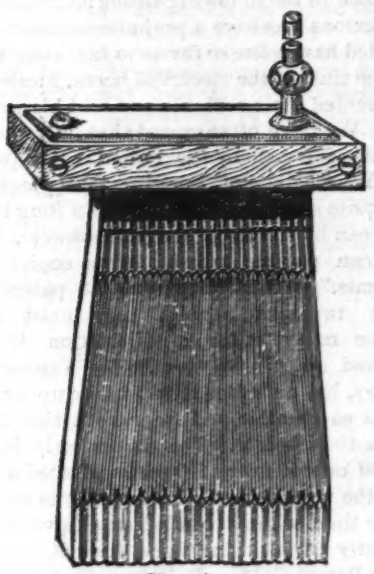


FIG. 2.

stances thus compressed against their conductive support, would enter better into activity. I obtained, in fact, more limited expansions and higher electro-chemical capacities by connecting to each other the folds of the electrodes by means of transverse solderings at the ends. But the resistance of the accumulator increased, because the liquid had difficulty in penetrating to the interior of these deep and compressed folds. The transverse solderings were also difficult and costly.

These difficulties disappear in the new electrode, with a cast frame, Fig. 3.

The active portion of this electrode consists of a band of rolled lead 0.95 metre long, 0.16 metre wide and $\frac{1}{4}$ millimetre thick. This band is then *striated* by passing between the rollers of a special laminator, which imprints upon it shallow marks at little distances from each other, Fig. 4 It is then perforated by some sloping slits and folded mechanically.

The folded plate, thus obtained, is introduced into a cast-iron mold, which leaves a suitable empty space around it. Melted lead is poured into the mold, so as to form the frame and solder it on all sides to the structure which it surrounds. External prolongations of cast-iron serving as a conductor and a support to the electrode, come in contact with the frame and form one body with it.

The cast frame is thus a physical and mechanical connection for all parts of the electrode, more solid than the ribs of the old plates. It resists the transverse expansion and effects an energetic compression of the superficial pulverulent materials which are thus brought into close and extended contact with the conductive portion of the plate.

The following are some numerical data of the new pattern electrode:

Width of plate	130 mm.
Total height	245 "
Thickness	5 "
Weight of folded part	900 grammes.
Total weight	1,500 "
Outer surface of electrode	5 sqr. dec. m.
Total developed surface	45 " "
Total effective surface	35 " "
Corresponding electro-chemical capacity	72,000 coulombs.

We see that the weight of the active portion seems to be three-fifths of the total weight; in reality, the fraction is greater, because the material of the frame is far from being completely inert. I could make a frame lighter by one-half, but I prefer to exaggerate the solidity of the system.

The electro-chemical capacity depends, naturally, on

FIG. 3.

the degree of formation. The figure given is not a maximum.

The formation is effected by the process of M. Gaston Planté. It is very rapid, especially if we previously attack the folds with nitric acid, according to the directions of this eminent physicist. The structure of the new plate enables the operation to be pushed very rapidly, as we have not to fear the fall of superficial matter, which is

FIG. 4.

retained very energetically between the wrinkled surface by compression.

The distance between the folds is regulated in such a manner that the mean density of the active portion is equal to 8. The density of compact metallic lead being 11.4, the folds leave at first a certain play-room between them; but the formation fills up the empty spaces, and cements the laminæ together. Thus the plate acquires a solidity which speaks well for its lasting power.

The 160 folds distributed over the width of the plate give it, however, in the transverse direction a sufficient elasticity to facilitate the very slight alternate movements of expansion and contraction required by the increase on charging and discharging.

The cast frame secures the mechanical solidity of the entire structure, so that the attackable surface of the active portion may be much increased by employing very thin sheet-lead. But the metal attains a very superior value when its thickness descends below $\frac{1}{4}$ millimetre. I have, however, stopped at this thickness for electrodes commonly made.

If it is desired, for special reasons, to increase very greatly the attackable surface of the active lead, we may with economy have recourse to another system of plates, which are described below.

In the manufacture of accumulator electrodes lead wire offers a large active surface for a given weight. One kilo. gramme of lead drawn into wire $\frac{1}{10}$ millimetre in diameter develops a surface of 116 decimetres square. The advantage of this large increase of surface has not escaped the attention of inventors, and several systems of accumulators with lead wire electrodes have been proposed. Since 1881 I have made electrodes in the shape of cables (French patent, No. 142,777, April 16, 1881), an arrangement which puts all the parts of the electrodes in communication with the exterior current terminal. Shortly afterward MM. Arnould and Tamine constructed plates of wires stretched parallel, almost touching one another, and united by continuous soldering at the ends. Later (French patent, No. 151,465, Oct. 7, 1882), M. Tommasi constructed accumulators, the plates of which were covered with a thick layer of wires.

These different systems worked well enough, but they did not come into general use on account of the expensive lead wire employed.

M. Simmen has removed this obstacle by inventing a means, as economical as it is ingenious, for producing lead wires of any length and thickness.

His method consists in pouring melted lead into a receptacle previously heated, the bottom of which is perforated with holes and has spouts of suitable dimensions.

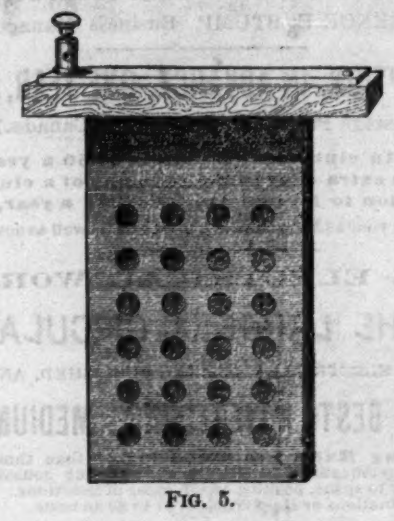


FIG. 5.

The metal passes out of these spouts in liquid jets or wires, and is quickly cooled in a basin of water, at the bottom of which it falls in the solid state.

The wire produced in this way does not possess the evenness of drawn wire; it is more or less wrinkled and the wires are interwoven in an inextricable mesh, which renders them incapable of being used in the general way; but they serve very well for the construction of accumulators.

M. Simmen tried to construct electrodes with his wire, but he was more occupied with the second part of his invention than with the first.

The Simmens plate, Fig. 5, consists of a laminated box of lead, perforated and filled with lead wire. The box, which screens a large part of the wire, nullifies considerably the increased surface gained with the lead wire.

But these inconveniences are not counterbalanced by an increase in solidity, for the perforated box begins to "form" very quickly, and is inevitably cut through at the level of the liquid; and then the whole fibrous mass which it supports drops down.

I advised M. Simmen to abandon this unpleasant reminiscence of Kabath's accummulators, and to seek a better method of employing his wire, the cheapness of which had at first captivated me. He then asked my

FIG. 6.

assistance, and our combined efforts have resulted in a new electrode, which seems to me to be quite successful.

The box support being condemned, it became necessary to find a means of keeping the wires together. Cabling and winding were hardly possible with the confused mass to be handled. But a valuable property of the original product was soon revealed by a microscopical examination of several samples, and suggested the manner of employing it. I have remarked that the Simmens wire is not smooth. Examined under the microscope it appears as composed of a series of drops joined end to end, like a series of irregular joints expanded and compressed. These breaks are advantageous, as they increase the surface and allow of the wire being packed or "felted," as it were. A handful of the wire, kneaded with the hands and then flattened with a hammer, is soon converted into a felted mass of a certain solidity.

Hence we supposed that our fibrous mass, subjected to a good compression in resisting molds, would give us a tenacious felt. A trial succeeded very well. A mass of wires subjected to pressure became a solid plate, which

* *L'Electricien.*

was nevertheless permeable, as it contained millions of cells.

The mean density of our plates depends upon the pressure exerted upon them. We have regulated this density to 8, like that of my corrugated plates (described above).

Notwithstanding the apparent disorder of our mass of wires, and its compression without previous preparation, the proportion of free and solid parts is quite regular; there is order in the apparent chaos.

THE WIRT VOLT INDICATOR.

The capillary structure of our plates ensures a rapid forming, an increased electro-chemical capacity and good internal conductivity. Moreover, these different qualities can be enhanced or moderated at the discretion of the constructor. The solidity and life of the electrode increases with the thickness of the wire employed; on the other hand, the rapidity of forming and the electro-chemical capacity increase with the fineness of the wires, and hence the possibility of imparting either of these qualities according to requirement. In practice we make the wire of the negative plate $\frac{5}{10}$ millimetres in diameter, and that of the positive $\frac{6}{10}$ mm. A frame of lead provided with supporting projections is cast around the plates, being an active part of the electrode. The frame unites very well with the felted portion, serving both as a support and as a conducting terminal, Fig. 6.

The size and capacity of the felted electrodes are very nearly the same as those of the folded plates; but their thickness and weight is less:

Length of plate	140 mm.
Total height	245 "
Thickness	4 "
Weight of felted portion	700 grammes.
Total weight	1,300 "
External surface of electrode	5.4 decim. sq.
Total developed surface	100 "
Active surface	85 "
Capacity, per pair	72,000 coulombs.

It goes without saying that the internal movements which take place during the forming are effected without weakening the active part, which latter is, so to speak, jointed in all directions throughout the mass.

I might, in conclusion, express an opinion on the relative merits of corrugated and *felted* plates for accumulators, but I prefer to await the results of experience, which will not be long hence. The works of Marly Fribourg and M. Paul Gadot employ corrugated plates, both as positive and negative; M. Simmen makes mixed accumulators with felted negatives and corrugated positives. Finally, a large electrical works has commenced a trial with both plates felted. The results obtained by these various skillful constructors will soon furnish good elements for comparison.

The Wirt Volt Indicator.

In the designing of a system of distribution for incandescent lighting, one of the principal objects to be observed is to so proportion the resistances that the potential in the various parts of the system shall be the same. It is rarely that this condition is realized, and one of the methods of overcoming the difficulty consists in placing lamps of reduced electromotive force in those portions in which the potential is below the normal. In order to ascertain the difference of potential in different parts of an incandescent circuit, the volt meter shown in the accompanying illustration has been constructed. It consists of a number of coils of varying resistance, arranged with plugs, as in a rheostat. These coils, in indicators for incandescent lights, have a total resistance sufficient to indicate up to 145 volts. For incandescent lines there is always 80 volts in the principal coil. This is balanced by a constant battery, connected with the galvanometer. If, therefore, the electromotive force to be indicated be exactly 80 volts, the galvanometer needle points to zero; if the electromotive force is higher, the galvanometer needle is deflected until, by taking out plugs and throwing in resistance, the needle goes to zero again. By adding the figures opposite to the plugs taken out, the electromotive force is obtained.

The instrument, which is made by the Stout, Meadowcraft Co. of this city, is complete in itself, and consists of the rheostat, constant battery, sensitive galvanometer and attaching cord. It is adapted for any system having an electromotive force of 80 to 145 volts. The minimum reading is 80 volts.

It will be seen from the cut that a connection with the circuit may be readily and quickly made, as all that is necessary is to unscrew a lamp and screw in the attaching plug.

The Thermal Telephone.

It is well known that Mr. W. H. Preece made some very interesting experiments with a telephone receiver, consisting of a fine wire stretched, and having one end attached to the centre of a diaphragm. When the current from a microphone transmitter was sent through the wire, the diaphragm reproduced the sounds. Some further experiments in this direction have been made by Mr. C. R. Cross at the Massachusetts Institute of Technology. The heaviest wire used was 0.0095 in. in diameter, and its material platinum. With a length of 6 in., the maximum effect obtained by Mr. Preece was observed. On using a wire .004 in. in diameter, and a current sufficient to raise it to a dull redness, very remarkable results were obtained from a length of 6 in. to 7 in. Not only could the most unfamiliar conversation be understood, but the words could be heard when the ear was placed at a distance of from 2 in. to 10 in. from the diaphragm of the receiver; the character and loudness of the sound being similar to that given by the Hunnings transmitter, with an ordinary magneto receiver. When a still shorter wire at the same temperature was used, a decidedly better quality of sound was produced, but the loudness was materially diminished. Lowering the temperature rapidly diminished the loudness of the sound. German silver gives good effects, but it is not so susceptible to temperature as platinum. Copper and iron gave unsatisfactory results. The battery used was of the type known as Grenet, and from one to ten cells were tried. The best effects were obtained from the wire .004 in. in diameter, and the remarkable point is that the raising of its temperature to red heat greatly enhanced the loudness.

The Machines Used in the Creil Experiments.

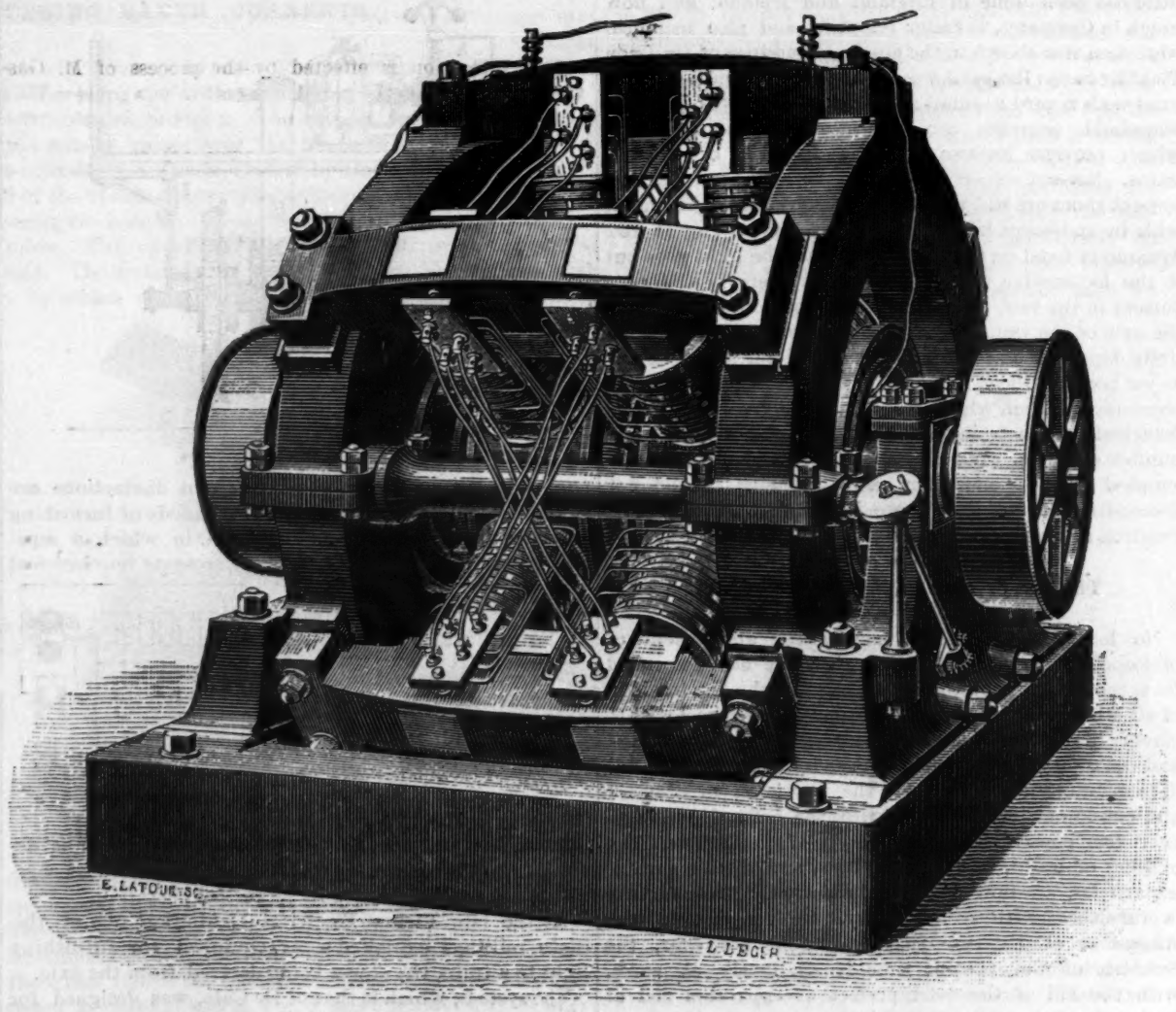
The high results which M. Deprez claims to have obtained in his latest experiment in the transmission of power, naturally draw attention to the machines he employed on this occasion. As might be expected, the form adopted is the result of an evolution in which those employed at Munich and Grenoble are elementary and intermediary stages. The general style of machine employed was the same in both generator and receiver, and is shown in the accompanying engraving, for which we are indebted to *La Lumière Electrique*. It represents the receiver. It will be seen to consist essentially of two armatures placed side by side, and of a series of horseshoe electro-magnets placed radially. The machines have been designed with special regard to simplicity and ease of access in case of repairs.

In the generating machine the field is produced by 8 electro-magnets of horseshoe form, and the pole pieces embrace the armatures over very nearly their entire circumference. The field is excited by a separate dynamo, and the current is passed through the different electro-magnets so that a north pole on one side of the armature is opposite a south pole on the other.

The total weight of each of the electro-magnets is 485 kilograms. They are wound with copper wire 2½ millimetres in diameter. The wire is covered with two layers of silk, one of cotton, and finally with a layer of shellac. The total length of wire wound on the magnets is 56,496 metres. The winding is done in sections, each having the form of a flat ring. Each section is composed of 11 layers of 25 convolutions each. The core of each electro-magnet carries 12 of these sections, and the ends of the wires are led to the terminal boards, so that they can be coupled up in any manner desired. The resistance of each section is 1.06 ohm, and the total resistance of the magnets grouped in series would be 203.52 ohms.

The radius of the pole pieces is 710 mm. and their thickness 120 mm. All the pole pieces on the same side of a horizontal plane passing through the shaft are in magnetic communication with one another.

The armature is wound in sections after the Pacinotti type, which presents the characteristic that it consists of a series of sections which can be removed and replaced in case of accident. The armature frame consists of a hub with a spider at each end. The sections are separately wound on soft iron cores and are then bolted to and between two opposite spokes on the shaft. Each segment of the armature winding is divided into 21 sections, and the wire is 2½ millimetres in diameter and insulated in the same way as the magnet wire. The following are the principal dimensions and weights:



DEPREZ MOTOR USED IN THE CREIL EXPERIMENTS.

No. of sections per segment	21
Total No. of sections	231
Length of wire per section	52 metres
Total length of wire wound on the ring	12,012 "
Diameter, external	1,386 mm.
" internal	1,070 "
Thickness of wire coil above core	33 "
" " " " below "	45 "
Length parallel to axis	606 "
Weight of wire, including insul.	559.5 kg.

In a preliminary trial this armature generated an E. M.

F. of 16 volts per revolution per minute. Each armature has its own commutator and brushes, the latter being attached to a holder, movable by a worm wheel, which gears with it.

Electric Lighting from the Civil Engineer's Stand-point.

In the course of an address the President of the Institution of Civil Engineers of Ireland made the following reference to electrical matters: "Electricity, which has done so much, and with which we have expected to do so much more in various ways, has not as yet produced a storage battery which is at the same time economical and occupies but a small space. We have not as yet arrived at the time when any one can, with reasonable economy, light his house with incandescent lamps at a price which will compare favorably with ordinary illuminants; and unless the ordinary householder is capable of understanding and attending to an engine and dynamo he must yet wait before he can gain the undoubted advantage of the electric light at a reasonable cost. With large spaces and certain classes of buildings, the case is very different; and when the arc light can, either with or without a certain proportion of incandescent lighting, be used to give large amounts of light, it is found to be economical as compared with its older rival, gas. I would, however, point out that the direction in which even greater economy could be obtained seems to be in the production of cheaper but still reliable carbons. Unless carbons are of the best possible kind they flicker and give off a large quantity of dust, which gets into and clogs up the mechanism of the lamps. In order to illustrate how important is the question of the cost of carbons, I may mention that in a large installation, with which I am familiar, the carbons cost 40 per cent. of the whole expense of working; wages amount to 30 per cent.; coal to only 14 per cent.; the remaining 16 per cent. being made up of all the smaller items of repairs, oils, tallow, waste, leather belts, etc. Those who have had anything to do with the erection of electric lighting plant cannot help being struck with the number of German workmen who are employed in connection with this work, and it is no doubt due to their possessing a greater knowledge of electricity and chemistry, which our own workmen have not the same facilities for obtaining; and this fact is but one of many which may be brought forward to illustrate the necessity of the establishment of technical and scientific schools in our large towns. How little has been done in England and Ireland, and how much in Germany, to foster scientific and also technical education was shown in the admirable address of Dr. Lyon Playfair to the British Association. The difficulties which exist with regard to small installations of electric light for household purposes are almost the same as those which prevent its use for the lighting of railway trains. Several experimental trains have been lit, and some of them are still running on various lines in England, with incandescent lamps. In one system an engine and dynamo is fixed on the locomotive, but the light goes out if the locomotive is detached, unless there is a storage battery in the van. In another the dynamo is driven from the axle of the van. In a third storage batteries are entirely depended on; but nothing that I am aware of has as yet been produced in a handy, and at the same time an economical, form, which will enable any carriage to be detached from a train and carry its lights with it for a number of hours. What is required is something of the simplest possible character, easily attended to and not demanding of lampmen more intelligence than is now required to turn a gas tap."

The Importance of Modern Chemistry.

No longer is chemistry merely the amusement of philosophers, says London *Invention;* it has descended from the laboratory into the forum. It is the handmaiden of all other arts and sciences. It enables the geologist to classify his specimens, and analyzes tissues for the botanist and the zoölogist. It touches modern life on all sides. It detects adulteration, enables the physician to discover and counteract disease, and with the help of the engineer has constructed the science of Sanitation. The making of bread, of butter, of beer, and of the commonest articles, are now chemical industries. Every factory is furnished with a laboratory. In contrast to the Alchemist of an age that has gone for ever, the Scientist of the present time is studiously at work, with the aid of the most perfect of apparatus and of books of reference innumerable, in solving the important problems of the day; and it must be admitted that his labor is fruitful of great results. In addition to the uses of chemistry in other arts, in increasing and cheapening the supply of materials, new industries have been created, employing thousands of men, and especially noticeable are the great results so rapidly following on the discovery of coal-tar colors and the method of producing *alizarine* artificially. This industry, of the annual value of $20,000,000, was created, not thirty years ago, by an Englishman still in the prime of life. It is a source of regret that we have been unable to retain the position we once held in this industry. Whether this is due to the advantage conferred on foreigners by our patent laws, or to the want of thorough scientific training obtainable in this country, the fact is equally to be lamented. We are the greatest producers of the raw material, and the chief users of the manufactured product, but nevertheless, we annually export half a million pounds worth of the former and receive it back at a cost of three millions. The old pre-eminence of England will not be again attained till the altered conditions of trade are recognized. It is not to our credit as a business nation, that we have been so slow to recognize the fact that the best practical chemist is he who has had the most thorough scientific education. It is only by being first in the field that success can be obtained, and this will be the case when our manufacturers discover that it is necessary to employ chemists of the highest class, as is done in Germany. No mere knowledge of technical details will qualify a man to manage an industry in which the methods of working so rapidly becomes obsolete.

Electric Lighting of Railway Trains.

There can be no doubt that the near future will see railway trains lighted by electricity, but the system which will be adopted is still problematical. The storage battery

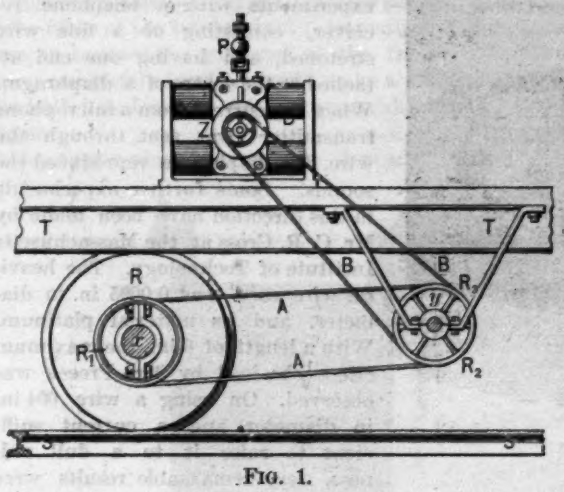


FIG. 1.

charged from stationary dynamos has been used, and even primary batteries have been tried for the purpose. Another system which has already seen some application is that in which the lights are fed from currents generated by dy-

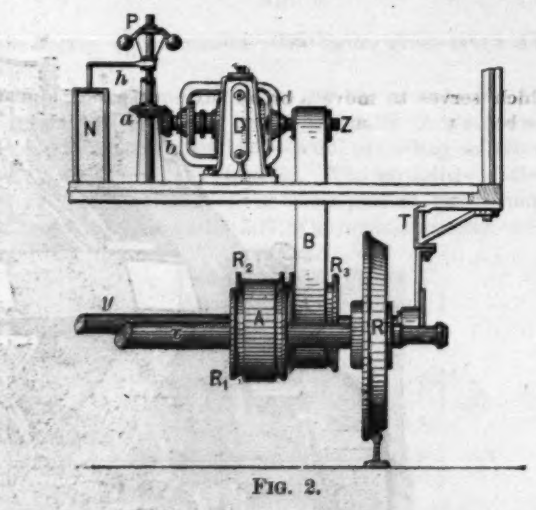


FIG. 2.

namos in the train. In the latter two distinctions are again to be made, and they arise in the mode of furnishing power to drive the dynamo. The first, in which a separate engine is used for the purpose, presents no electrical

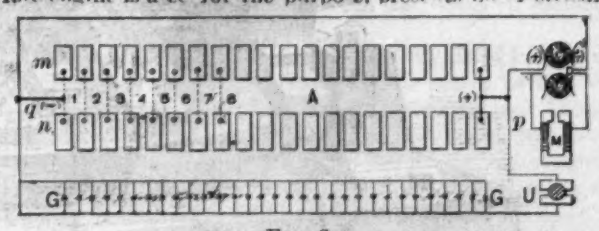


FIG. 3.

difficulties; but the second, in which the power is derived from the axle of the wheels, requires certain arrangements and precautions for its successful operation.

At the late Vienna Electrical Exhibition one of the State railways exhibited a car equipped for furnishing light to a train, the power being derived from the axle.

The system, which is that of De Calo, was designed for an express train between Vienna and Trieste, and while attaining a speed of 60 kilometers on a level, it slackened down to 28 7 kilometers on a rising grade during 1 hour and 40 minutes. Consequently provisions had to be made for keeping the intensity of the lamps constant notwithstanding the change of speed.

For this purpose De Calo arranged a dynamo in a car, as shown in Figs. 1 and 2, the power being transmitted by belts *A* and *B*. The counter shaft *y*, carrying the pulleys R_2 and R_3, is provided for the purpose of preventing the irregularities in the tension of the belt (caused by the rise and fall of the axle), from being transmitted to the dynamo. In the arrangement shown, this irregularity of motion is effectually provided for.

As long as the train runs at its normal speed the dynamo furnishes the current for the incandescent lamps, but during the "dead revolutions" of the wheels, or when the train is at a stand still, two series of twenty storage batteries each are thrown in circuit. The batteries must be charged when the train is started, then discharged as well as recharged during the run, so that at the end the batteries are well charged. The charging of the batteries is also done by the dynamo on the train, and consequently arrangements had to be provided to prevent the reversal of polarity which dynamos are subject to when charging accumulators. For this purpose the armature of the dynamo has two independent windings; one of these, of heavy wire, is connected with the external circuit; the other, of finer wire, is connected with the field magnet coils. This is shown diagramatically in Fig. 3. There are thus two independent circuits, each winding having its own commutator *c*, *c'*, of which there are two on the shaft, and each having its own set of brushes.

The arrangement of the circuits is shown in Fig. 3. By means of the plug switch *U* the thirty-two 8 c. p. lamps *G G* can be cut out entirely. When the plug is removed, the current takes the course at *p*, through the accumulators *A* to *y*, and thence back to the dynamo, charging the batteries solely.

When the plug is inserted, the current from the dynamo divides at the point *p*, part going through the lamps, and part through the accumulators *A*. But as will be seen, the accumulators are now also in circuit with the lamps so that the latter are lighted when the dynamo furnishes no current.

It is also necessary to provide arrangements, first, for cutting out the battery below a certain speed of the dynamo; secondly, for closing the main circuit of the dynamo, when a certain speed is attained; and, finally, so that with increasing intensity of the dynamo current a corresponding number of accumulators are cut out—which is accomplished by sliding the connection at *g*, Fig. 3, along 2, 3, 4, 5, etc., so as to maintain the E. M. F. at the lamp terminals constant.

All this is done by an ordinary centrifugal governor *P*, Figs. 1 and 2, which communicates with the shaft of the dynamo by bevel gears. The rising and falling arms of the governor move the lever *h* of the cut-out *N*, which shifts the sliding contact on the corresponding cell.

When the dynamo reaches a speed of 500 revolutions per minute, all the accumulators are cut off.

On the Theory of the Electro-Magnetic Telephone Transmitter.

BY M. E. MERCADIER.

The first point to be studied in this theory is the part played by the iron or steel diaphragm of the telephone.

1. From the *elastic* point of view, as regards the nature of the movements which it effects. 2. From the *magnetic* point of view, in the transformation of the mechanical energy into magnetic energy resulting fom its movements.

I. If there are produced in the air in front of the diaphragm vibratory movements, simple or complex, like those resulting from articulate speech, either the fundamental and harmonic sounds of the diaphragm are not produced or they play merely a secondary part.

In fact: 1. The diaphragms are never set in vibration as it is supposed, if we wish to determine the series of the harmonics and of the nodal lines, for they are not left to themselves when they have been set in motion. No free play is given to the action of the elastic forces. In a word, the vibrations effected are constantly forced.

2. If a disc is absolutely set in a groove, when its borders are fixed, theory indicates that the first harmonics of the free disc ought to rise only a little. Let us take discs of steel of 0.10 metre in diameter, and only 0.002 metre in thickness, the fundamental sound of which, in the free state, is about ut_5, and which is further raised by framing in. We do not see how this fundamental and the harmonics can be brought into play when there is produced before the disc a continuous series of sounds or of accords of a pitch below ut_5, or when a man, the pitch of whose articulate speech is always in the gamut of index 3, speaks into a diaphragm of this kind. Nevertheless, these sounds and this speech are perfectly reproduced (with a feeble intensity, indeed, in an ordinary telephone) with their pitch and their timbre. They produce, therefore, in the transmitting diaphragm, movements other than those of the fundamental sound and of its particular harmonics.

3. It is true that in practice the edges of the telephonic diaphragm are in no manner fixed, but merely inclosed between pieces of wood or of metal, the mass of which is comparable to their own; they are, therefore, as regards elasticity in conditions not well determined. Still, a diaphragm of ordinary diameter (from 0.05 to 0.10 metre) and very thin (from 0.25 to 0.5 millimetres in thickness), inclosed in this manner at its edge, is capable of vibrating if a continuous series of sounds is produced near it, by means, for instance, of a series of organ-pipes. But the series of sounds which it distinctly strengthens by manifesting complex nodal lines is visibly *discontinuous;* how, therefore, can its existence suffice to explain the production of a continuous scale of sounds—sounds, isolated or superimposed, which is the essential property of the telephone?

4. The interposition between the diaphragm and the source of the vibratory movements of a plate of any sub-

stance whatever, in nowise affects its telephonic qualities, nor, consequently, the nature of the movements, which would be very surprising if it were these which correspond to the particular sounds of the diaphragm. This fact is already known. I have verified it with mica, glass, zinc, copper, cork, cotton, wood, paper, feathers, soft wax, sand and water, taking certain of these substances even in thicknesses of 0·15 to 0·20 metre.

5. We may put a diaphragm manifestly out of condition to produce its particular scale of harmonic sounds by loading it with small masses irregularly distributed over its surface, by cutting it in form of a wheel or by piercing

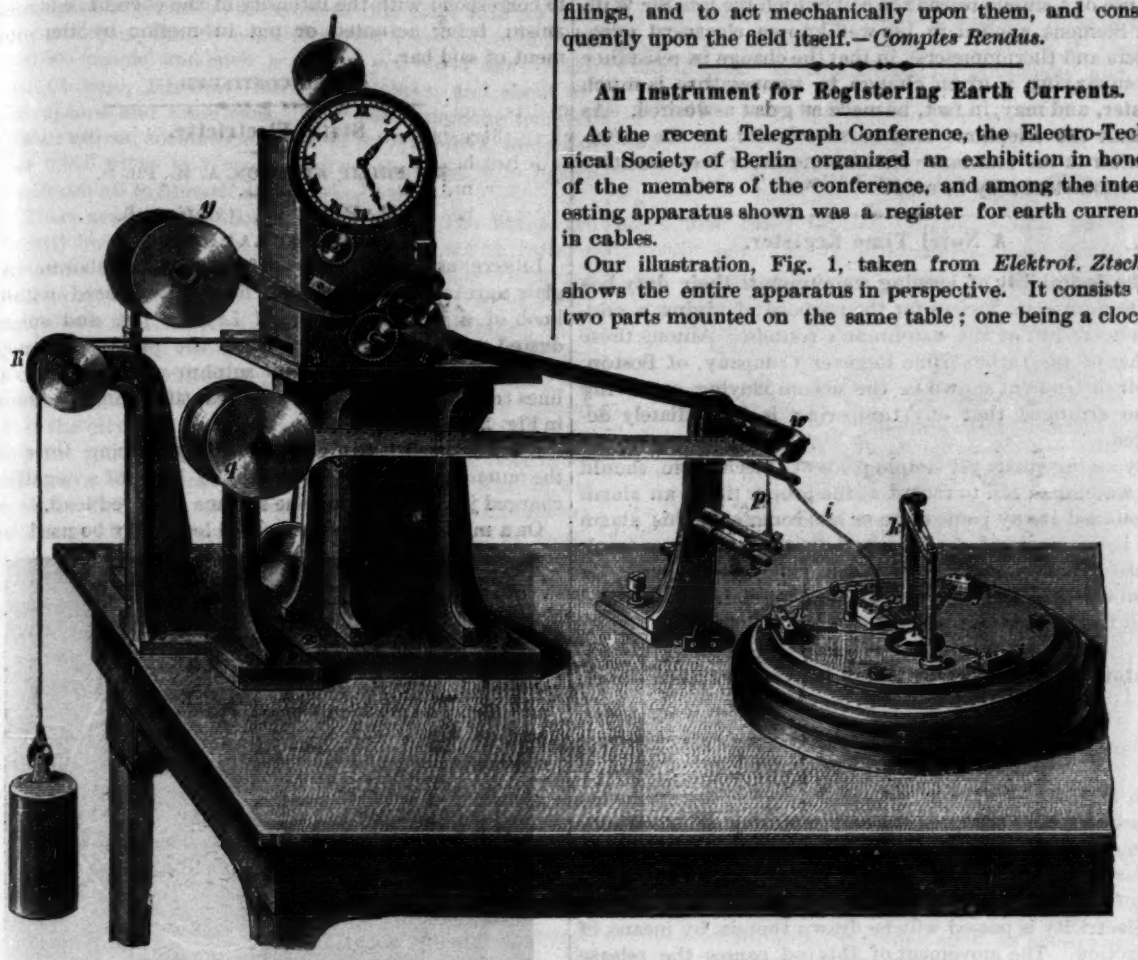


FIG. 1.—INSTRUMENT FOR REGISTERING EARTH CURRENTS.

it with holes, so as to deprive it of the half of its mass. None of these modifications destroys its telephonic properties.

6. We may go still further and employ diaphragms of a rigidity and elasticity almost nil without affecting the essential telephonic properties, that is the reproduction of a continuous series of sounds of accords, etc. Such is the case with a diaphragm of sheet iron. It is very difficult then to imagine a fundamental sound and its harmonics.

The conclusion of all this seems to me to be that the mechanism in virtue of which telephonic diaphragms execute their movements is at least analogous to if not identical with that by which solid bodies of any form—a wall, for instance—transmit to one of their surfaces all the vibratory movements, simple or complex, successive or simultaneous, and varying in period in a continuous or discontinuous manner, which are produced in the air in contact with the other surface. In a word, we have here a phenomenon of *resonance*. In diaphragms of a sufficient thickness this kind of movement would exist alone. In slender diaphragms the movements corresponding to their particular sounds may be superposed on the former, a superposition more troublesome than useful, for if there results in these cases a strengthening of the effects produced, it is at the expense of the timbre, as the harmonics of the diaphragm can only by the greatest chance coincide with those of the sounds which bring into play the fundamental sound of the diaphragm, as experience distinctly proves.

II. Let us now pass to the magnetic part of the telephonic diaphragm. This part may be clearly defined by the following facts.

1. The presence of the magnetic field does not at all modify the foregoing conclusions.

2. By diminishing more and more the rigidity and elasticity of the diaphragm, I succeeded in suppressing it completely. It is sufficient to substitute for it in any telephone, a few grains of iron filings, thrown upon the pole of the magnet, covered with a piece of paper or pasteboard, in order to reproduce, though with a very feeble intensity, all sounds and articulate speech, with its characteristic tone.

3. To augment the intensity of the effect produced, it is sufficient to substitute for the iron diaphragm, a slender disc of any substance, slightly flexible, whether metallic or not, *e. g.*, pasteboard, and to spread over it, across the opening of the ordinary cover of the instrument, 0.1 or 0.2 grm. of iron filings, which marks out in the space the lines of force.

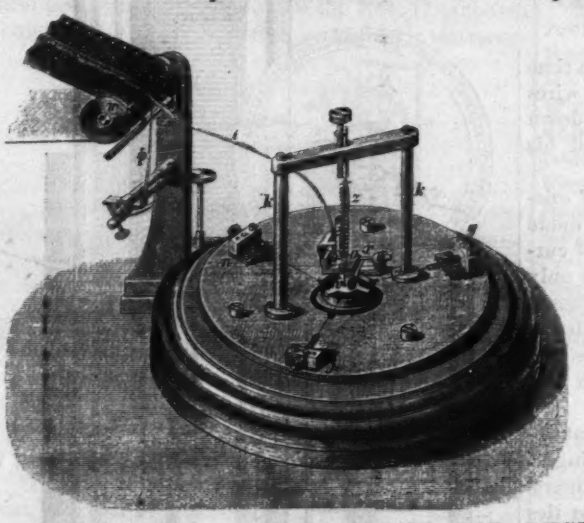
We obtain thus an iron-filings telephone. By suitably increasing the intensity of the magnetic field I have been able to obtain telephones of this kind, producing in an ordinary receiver effects as intense as the ordinary transmitters with rigid discs, and, like them, reversible. For a field of given intensity there is a weight of filings which produces a maximum effect.

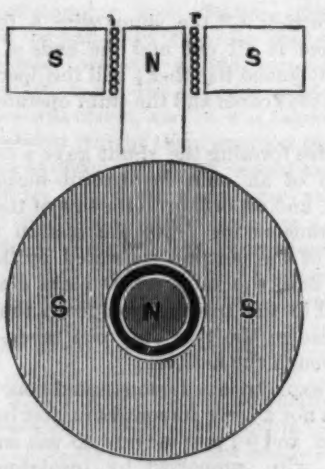
We see thus that the advantage of an iron diaphragm over filings is reduced to presenting in one and the same volume a much more considerable number of magnetic molecules to the action of the field and to external actions. It increases the intensity of telephonic effects; but to produce them with all their variety, their delicacy and their perfection, it is by no means indispensable: it is sufficient to materialize in some manner the lines of force with iron filings, and to act mechanically upon them, and consequently upon the field itself.—*Comptes Rendus.*

An Instrument for Registering Earth Currents.

At the recent Telegraph Conference, the Electro-Technical Society of Berlin organized an exhibition in honor of the members of the conference, and among the interesting apparatus shown was a register for earth currents in cables.

Our illustration, Fig. 1, taken from *Elektrot. Ztsch.*, shows the entire apparatus in perspective. It consists of two parts mounted on the same table; one being a clockwork which serves to move a broad strip of paper, and the other being the actual registering apparatus, which is shown enlarged in Fig. 2. The strip of paper is attached to the roller *q*, passes over the stretcher *w*, and thence to the cylinder *e*, which is driven by clockwork. The rear end of the cylinder is provided with radial pins, and these, entering the holes in the perforated paper, cause the latter to move. The upper roll *y* serves to wind up the paper passed. The under side of the paper is lamp-blacked every day by means of an oil lamp. The action of the earth





FIGS. 2 AND 3.—INSTRUMENT FOR REGISTERING EARTH CURRENTS.

current is recorded by a pointer, and the indications are given a permanent character by brushing the lamp-black surface with colophony dissolved in benzine.

A Siemens bell-magnet energized by 20 cells is screwed to the under side of the table. In the ring-shaped space between the poles *N* and *S*, Fig. 3, there is placed a coil of fine wire *r*, through which the earth current passes. An aluminium plate of peculiar form is attached to the upper projecting edge of the coil, shown at *v* in the centre of Fig. 2. From the centre of *v* a spiral spring *Z* rises and is suspended from a transverse support, so that the fine coil is suspended at this point. In order to guard against lateral vibrations, the aluminium plate is held taut by three fine wires attached to the screws *g*, *j*, and *n*. A small wheel attached to the end of a lever bears on the plate, and the pivotal axis of the lever *x* carries a long pointer *i* and a counterweight *o*. The pointer is provided with a fine ivory point, which presses against the lamp-blacked paper. A second stationary pointer marks a continuous zero line. The current from the cable enters at the binding screw *j*, through the attached wire into the fine wire coil *r*, out through the wire attached to *g*, and thence to earth.

Each current strength corresponds to a certain position of the coil with reference to the magnet poles, and every variation of current either causes the coil to rise or sinks it deeper into the hollow. These vertical movements are transmitted to the small wheel and lever, and consequently to the pointer *i*, which records them in greatly enlarged horizontal deflections, which are exactly proportional to the current strengths.

The apparatus gives a continuous record of variations of earth currents, and about 320 mm. is the length of the curve obtained every 24 hours. The necessary time-marks on the paper are made by a clock. The latter has a contact at the figure XII., which is part of the circuit with the fine coil. As the minute hand arrives at twelve the circuit is momentarily broken, and the time is thus indicated on the paper. The sensitiveness of the apparatus is tested daily by comparison with a standard Daniell cell.

A Remarkable Fact Developed in Telegraphing To and From Moving Trains.

For the past few weeks the Phelps Induction Telegraph Company have been making the surprising statements that they can equip a railroad with their system at an expense of $50 per mile or less, as against $300 per mile according to their previous estimates. The reason for this remarkable reduction in price, as explained by Mr. Phelps, is as follows:

"When we equipped the Harlem River Branch of the New Haven Railroad, about a year ago," said he, "as an experimental plant, there was so much doubt expressed on all sides, as to whether it was possible to accomplish what we intended, that it was thought advisable to spare no pains nor expense in making the plant as perfect in every feature as possible, consequently we used the very best wire, which cost us $150 per mile, and protected it in a wooden box that cost $100 per mile, and the labor amounted to $50 per mile. But after getting the plant in daily operation we were surprised from time to time to find how easily we could maintain communication with the moving train; how little battery was necessary, ten Bunsen cells being sufficient at the terminal station and two cells on the car. Early last spring I wished to ascertain how much resistance I could insert on the line and still receive from the car. I put six cells of Bunsen battery on the car and connected my resistance box in circuit with the line. I then introduced resistance until I had cut in fifteen thousand (15,000) ohms and still heard the signals distinctly. I could have put in more, but that was the capacity of my resistance box.

"We accidentally discovered one day that we could work to the wire when it was four feet away from the coil on the car, and this discovery led us to believe that it would be possible to work upon the down track, in which case the coil upon the car would be over eleven feet from the conductor upon the other track. By increasing the battery at the terminal station to 30 cells and the battery on the car to 10 cells we found that it was not only possible but perfectly practical, and for several months past we have been working on both tracks with the wire on only one.

"At a meeting of the directors a few weeks since the question came up whether the high insulation of our conductor might not be dispensed with and an ordinary iron telegraph wire used supported on insulators. The objection to this method naturally was that the snow and slush would at times so impair the insulation as to render the line useless. The result of the discussion was that on the following day Mr. Cheever and myself made some experiments, with a view of ascertaining just how much leak we could allow on the line and still maintain communication with the train.

"We attached a No. 12 copper wire to the main line just as it entered the office and another to the ground wire, bringing the ends of these two wires down to a table in a convenient position to introduce any desired amount of resistance. When the ends of the two wires were connected together, they formed a direct short circuit or shunt around the instruments and batteries in the office

and any amount of resistance interposed in the shunt would represent the leak or wasted portion of the current both in sending and receiving.

"The line between New Rochelle and Harlem River has a resistance of 100 ohms; the telephone receivers used had a resistance of 70 ohms. We used in the experiment 30 large Bunsen cells at the terminal station, and 11 small Bunsen cells on the car. The transmission both ways was by means of the buzzers in daily use upon the line.

"When we introduced a coil of one ohm in the shunt, all the noise of the line appeared to be shut out and the signals came faint, but very clear and distinct, and could be read as easily as when the whole line was clear. Then we introduced one-half an ohm, and then a quarter, and still the signals were perfectly clear and distinct. We then cut the resistance of the shunt down to one-tenth of an ohm, and still the communication was maintained and messages were transmitted and written down, but it was so faint that it required the expert ear of the operator who was familiar with the sound to catch it.

"We had used as resistance a piece of No. 14 copper wire a few feet long, and as we wished to ascertain the very lowest point to which the resistance could be reduced before communication was entirely shut off, we commenced cutting off the shunt wire a few feet at a time until we had it all out and the ends of the heavy wires were firmly joined together; still the operator wrote down the words that came and the train operator answered his call.

A NOVEL TIME REGISTER.

"The wire forming the shunt gave a resistance of one-hundredth of an ohm by careful measurements made afterward, and according to the law of the division of currents, in transmitting from the station to the train only .0001 part of the current generated by the battery passed over the line, the other .9999 parts going through the shunt, and in the transmission from the car, of the current induced on the line only one seven-thousandth part passed through the receiver.

"These experiments demonstrated conclusively that insulation is not a very important matter in the working of our system, and we propose now to use only an ordinary telegraph wire, supported by insulators upon the ties about three inches outside and just below the surface of the rail. The insulators will be about 25 feet apart and of a special design. The coil upon the car will be outside the wheels, passing forward on one side of the car and back on the other, so that either side of the car may be turned to the wire.

"In this manner a railroad can be equipped with our system as cheaply as an extra wire can be put upon poles that are already standing, and if poles are to be erected, as in case of a new road, it can be equipped with our system at half the cost of a pole line."

On a Differential Resistance Thermometer.

This consists essentially of a mercurial thermometer, says the London *Electrician*, having a greatly enlarged bulb, so that the stem may have a diameter of something like a millimetre, and still keep the scale tolerably "open." There runs through the stem a fine platinum wire of 0.08 millimetre in diameter. The lower end may be secured in the bulb, so that it is kept straight in the bore of the stem, and at the lower end a heavier wire is sealed in the glass, so that metallic contact can be made with this wire both at the upper end and through the mercury at the lower. The resistance between these two points evidently depends largely on the length of the platinum wire which is above the mercury in the tube, and this will depend upon the temperature to which it is exposed, the resistance diminishing with rise of temperature by an amount equal to the difference between that of the platinum wire which disappears and that of the mercury which takes its place, less the increase in the resistance of the platinum wire and the mercury due to rise of temperature. Mr. J. C. Mendenhall considers this method has an advantage over the use of a simple resistance coil (which the late Sir William Siemens applied in his well-known electrical pyrometers and thermometers), in that the change in resistance accompanying a given change in temperature is much greater, and may, in fact, be made as great as desired. As a result the telephone may be substituted for the galvanometer in the resistance measurements, or less sensitive galvanometers may be used.

A Novel Time Register.

The desirability of keeping watchmen to their duty has led to numerous devices for the purpose of giving a continuous record of the watchman's rounds. Among these is that of the Tarbox Time Register Company, of Boston. Their instrument shown in the accompanying engraving is so arranged that any tampering is immediately detected.

By an ingenious yet simple piece of mechanism, should the watchman fail to record at the proper time, an alarm is sounded at any point more or less remote. This alarm can be so arranged as to sound in the superintendent's house or police office or any other designated place. Or should the clock for any reason stop, an alarm will sound until the fault is rectified.

History of the Electric Meter in America; Its Development and Various Forms.

BY F. B. BROCK.

(*Continued.*)

In 1879, Mr. Benjamin F. Card devised an apparatus for measuring both the quantity and intensity of electricity by means of a peculiar mechanism.

Card's invention is based upon the principle that a rod of soft iron placed within a helix through which a current of electricity is passed will be drawn therein by means of induction. The movement of this rod causes the release of a spring-driven train of gears, the speed of which is varied by the position in which a friction wheel (moving with the core of the helix) is brought in contact with a friction cone.

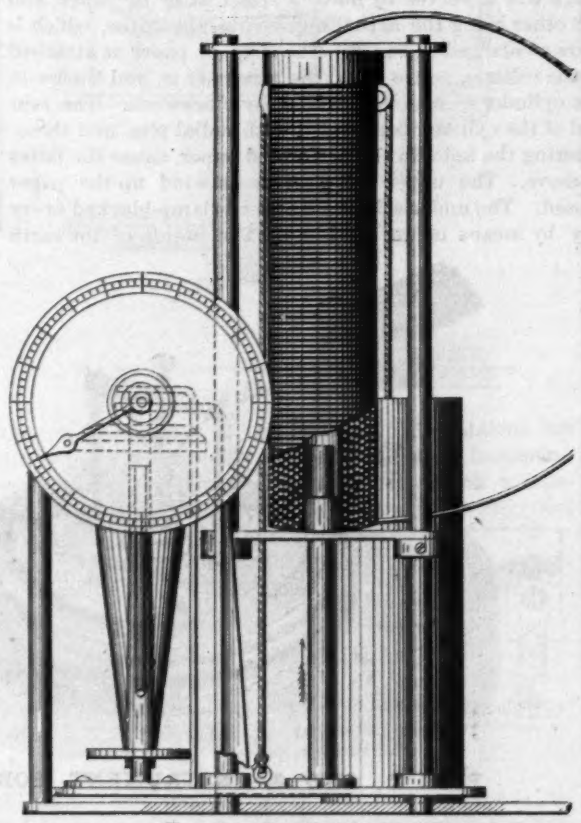


FIG. 5.—CARD'S METER.

Fig. 5 shows the Card electric meter. When a current of electricity is passed through its helix its iron core is instantly magnetized and drawn up into the helix, or in the direction shown by the arrow. This action, in connection with a counterbalance weight, causes the horizontal flat plate shown at the bottom of the figure to be raised up, the same action also releasing the train of gears which are behind the register face to be set in motion. The clock-work is directly geared with the friction cone shown in the view. In contact with this revolving cone is a friction wheel mounted on the shaft, shown in front of the cone, and which moves up or down according to the movement of the helix core. If the current should vary in intensity the core will be moved correspondingly up or down, thereby carrying the friction wheel in contact with the cone to the same degree. The more intense the current the higher the friction wheel will be carried in contact with the cone, and the cone being of greater diameter at its upper end will impart an increased speed to the friction wheel corresponding to the intensity of the current. The friction wheel is geared directly with the registering dial, which revolves fast or slow accordingly.

Mr. Card's broadest claim is as follows:

"The method of measuring the quantity of electric current by causing the same to pass through a helix, and thereby operating a movable bar of iron, said bar of iron being connected to any suitable mechanism moving an index or measuring arm at each moment with a velocity to correspond with the intensity of the current, said mechanism being actuated or put in motion by the movement of said bar."

(TO BE CONTINUED.)

Static Electricity.

BY PHILIP ATKINSON, A. M., PH. D.

CHAPTER VI. (*Continued*).

ACCUMULATORS.

LICHTENBERG'S FIGURES.—If on a plate of ebonite, or of glass varnished with shellac, figures be traced with the knob of a positively charged Leyden jar, and sulphur dusted over the surface, inclining the plate and tapping it to remove the surplus, the sulphur will adhere to the lines traced, spreading out in a beautiful fringe, as shown in Fig. 26.

A similar result can be obtained by tracing lines with the outside of this jar, or with the knob of a negatively charged jar, and dusting the surface with red lead.

Or a mixture of sulphur and red lead may be used, and

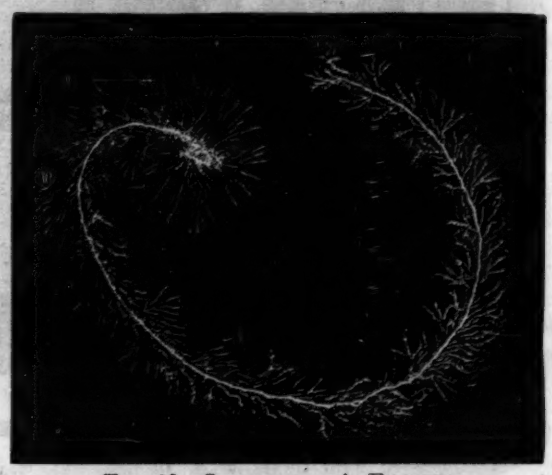


FIG. 26.—LICHTENBERG'S FIGURES.

separate figures traced; the jar being charged positively for one figure and negatively for the other. The sulphur, it is claimed, adheres to the positive and the lead to the negative lines; but the proof of this is not clear. Any non-conducting surface may be used, also various other powdered substances.

It should be noticed that the loss of charge, whether positive or negative, from the inner coating, while tracing the figures with the knob, is balanced by an equal loss from the outer coating through the hand in which the jar is held. Hence, when the tracing is made with the outer coating, the knob must be held in the hand to produce the same effect on the inner coating, the jar being first placed on an insulator to prevent a discharge and consequent shock, by indirect connection through the earth.

An inspection of the figure shows that at the point where it begins above, the fringe lines radiate from a common centre, but that as the curve is produced from right to left downward and from left to right upward, they point diagonally in the direction in which the knob of the jar moves. The explanation is as follows:

The surface being a non-conductor, the electricity has to force its way against strong resistance, bursting through at the points where resistance is least, and forming the fringe.

The strongest effect is produced where the knob first approaches the surface, as the jar has then a full charge, and the first action is a disruptive discharge through the air, producing the circular, star-like figure at that point.

But as the knob moves along the surface, after contact, new lines start out at right angles to the line of movement. And as the knob leaves a point where such a line has started, it exerts an inductive action on the original impulse, which tends to turn this line forward, the diagonal direction being the resultant of these two forces acting at right angles to each other.

The forked branches are the result of similar inductive action of the main fringe lines on the branch lines.

We have in this experiment a graphic demonstration of the effect of an insulating surface in resisting electric movement, since the figures show the exact location of the electric force, which we see is confined chiefly to the tracings, spreading only to the limited extent represented by the fringes.

It also shows that the effects produced in different substances by opposite electric influences are dependent on the electric condition of the substances themselves, so that a mixture or a compound may, in this way, be separated into its elements. The sulphur in this experiment becoming negative, as claimed, by friction, is attracted to the positively charged lines, while the red lead, becoming

positive, is attracted to those negatively charged. This principle has numerous useful applications in the arts.

(TO BE CONTINUED.)

American Telegraphers in Siam.

It will be remembered that four telegraphers left New York recently to take positions in the telegraph service of Siam. One of them, Mr. Martin J. Dixon, thus writes from Bangkok about his experiences:

"UNIVERSAL HOTEL, BANGKOK, SIAM.

"I have just returned from a walk, and must confess I am glad to get back once more to this place that we have to call home. Bangkok is a city with a population of about 500,000 people, and such a medley you never saw—Siamese, Chinese, Hindoos, Burmese, Malays, and about 500 Europeans and Americans. There are gorgeous temples, public offices, accommodations for 8,000 soldiers, and room for 3,000 wives and concubines of the king, who has an inclosure all to himself and is never seen.

There are only two hotels in the place. The houses are mostly built of wood on posts, and many are on rafts on the river Menam, eight and ten houses being sometimes on one raft. There is only one decent street in the city, and that's the dirtiest I have ever seen—the Italian quarter of New York being scrupulously clean in comparison. They have no sanitary regulations, all the filth being left on the streets or dumped into the river, and it's a wonder that the city is as healthy as it is.

"But you ought to see the natives. Phew! I've often wished in New York, when the thermometer was in the nineties, that we could dispense with some unnecessary clothing. The Siamese have reached the height of tropical comfort, for neither males nor females wear more than a sash, and to a white man the fashion is revolting. They are a filthy lot, too, paying no regard to cleanliness.

"If one had a constitutional objection to water Bangkok is just the place to come to. Here in the hotel we have good water, but some of it is brought by steamer from Hong Kong—somewhere about 1,500 miles. Just now we get some distilled rain water, this being the rainy season, which lasts for three months, the rainfall beginning at 3 P. M. and lasting three hours every day. It is a godsend, and cools the air and washes the streets.

"Many American residents have visited us, and we have received any number of invitations to dinner, but as it is customary to return the invitation, and as living here is expensive, we have had oftentimes to decline the intended kindness with thanks.

"The telegraph business in Siam is very slow. They do about twenty-five messages a month, but rumors say they contemplate great things in the future. We have been here nearly three weeks and have yet done nothing. The Siamese are very slow. I was told of an Englishman named Davidson who was here for two or three years, and all he did was to sign the vouchers for his pay.

"I am getting awfully tired of this easy life, and wish, when I go to bed, that I might wake up and find myself in New York or some other part of America. If I ever get back, you will not be able to get me out of it with a derrick."

Steam Boiler Inspection.

As so many of our readers have to do with steam boilers, we print the following, which will be of interest to them. It is a report of the financial condition of the Hartford Steam Boiler Inspection and Insurance Company, made after a careful examination of its condition by the Insurance Departments of Minnesota and Illinois on Aug. 10, 11 and 12. It bears the signature of Mr. A. R. McGill, Insurance Commissioner of Minnesota, and of Mr. J. J. Brinkerhoff, Examiner of Illinois. This examination was made at the company's request, on account of reports circulated in the Northwest that their financial condition was unsound:

GENTLEMEN: Herewith find a statement of the assets and liabilities of the Hartford Steam Boiler Inspection and Insurance Company, as ascertained by us from an examination of said company just concluded:

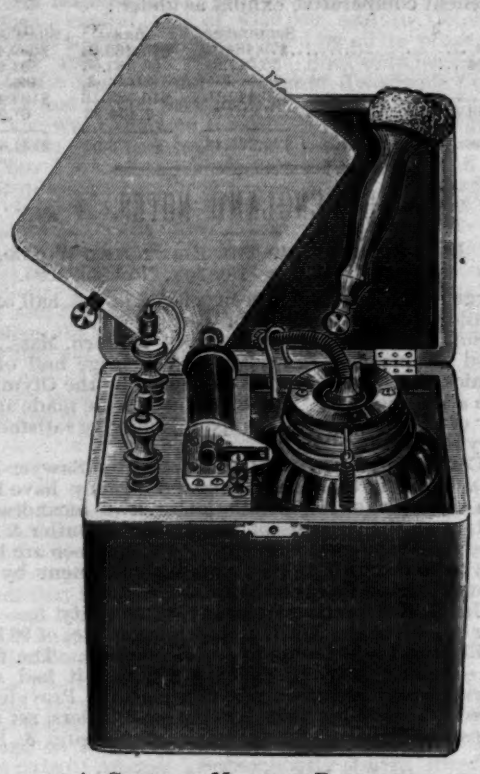
The financial condition of the company is in every sense satisfactory. It had on the 10th of August, inst., $527,194.55 of good interest-paying assets, and but $172,561.53 of liabilities, aside from its $250,000 of capital stock, and showed a clear surplus to policy-holders of $354,633.02, and a net surplus of $104,633.02. The investments of the company may be regarded as first-class. It is rather a remarkable fact that out of a total of 257 real estate mortgages, securing $216,300 of loans, there is no over-due interest. We found the books, papers, and accounts of the office in admirable shape. Order and method prevailed in all parts of the company's business. Its management is able and skillful. We were especially impressed with the small proportion of "losses" to the total expenditures. The governing idea in the company's business seems to be, "an ounce of prevention is worth a pound of cure," and consequently its heaviest expenditures are incurred in its inspection, or what might be called its "preventive" department. In 1884 it expended in this department $101,954.66, and its total losses were but $16,278.34. It is very plain that the small loss account is but the inevitable consequence of the admirable and thorough inspection system enforced by the company. It would be a blessing to the country if the same system could be generally applied to the fire insurance business.

It affords us much pleasure to be able to testify to the soundness and strength of the Hartford Steam Boiler Inspection and Insurance Company. It has no weak places under its present able management, and is not likely to develop any. The company is worthy the fullest confidence.

J. J. BRINKERHOFF, Examiner for Illinois.

Electro-Medical Apparatus.

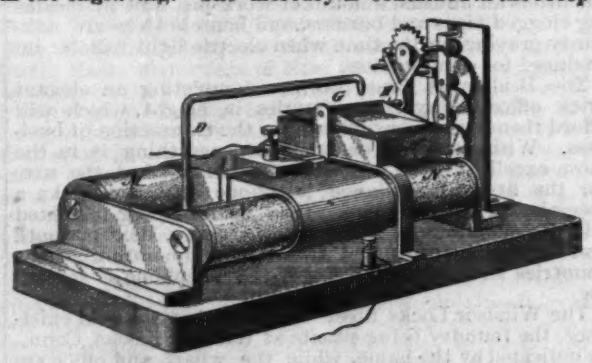
Our illustration represents a compact form of medical apparatus, designed by Messrs. Partrick & Carter, of Philadelphia. It is intended for physicians' and for private use, and contains induction coil and battery. It also includes the suitable electrodes, such as sponge and footplate, all being neatly inclosed in a mahogany box.



A COMPACT MEDICAL BATTERY.

An Ingenious Electric Meter.

The phenomenon observed by M. Lippmann that a column of mercury contained in a U-tube placed in a magnetic field would rise in one branch and fall in the other when a current is passed through, has been utilized by him in the construction of an electrical meter. M. Lippmann used a permanent magnet to produce the field; but in a recent improvement Mr. Edward Weston has substituted electro-magnets in their stead, and his apparatus (pat. No. 330,451, Nov. 17) is shown in the engraving. The mercury is contained in the receptacle *A*, and the current led to it by means of platinum plates. From the lower part of the receptacle a tube *D* passes out, and is bent horizontally as shown. The end of the other branch is enlarged and provided with receptacle *F*, sufficiently large for maintaining the level of the mercury approximately constant.



AN INGENIOUS ELECTRIC METER.

Instead of allowing the mercury to fall directly from the tube *D* into the receptacle *F*, it is collected in a device for measuring its amount. This consists of a pivoted tray *G*, divided into two parts by a central partition. The mercury which is carried over by the action of the current falls into one side of this tray until it overbalances and tilts, allowing the mercury which has accumulated to run out into the receptacle *F*, and bringing the other side of the tray under the tube *D*. The tray is fixed to a rock-shaft *H* that carries a bifurcated pawl operating on a star or sprocket wheel, forming one of a train of registering-gears. The oscillations of the tray impart an intermittent rotary movement to the wheel and to the registering-train, and the number of oscillations, and consequently the quantity of mercury that has passed from one tube to the other, is thus determined. Knowing this, the units of current strength that have produced the transfer of mercury may be computed or indicated directly, as the quantity of mercury transferred is proportional to the number of current-units that have passed through the apparatus.

To produce the magnetic field Mr. Weston uses electro-magnets *M N*, which are placed on opposite sides of the receptacle *A*. The magnets have large pole-pieces of opposite magnetic polarity, and between them the receptacle is placed, as shown. The coils of the magnets are of comparatively fine wire, and when the apparatus is used as a meter with translating devices in multiple arc, the main current is passed through the mercury and receptacle, and the coils of the magnets are included in a cross or multiple arc circuit.

The Law Bearing on Telegrams.

A man went to a telegraph office in Frankfort, Ind., to send a dispatch which called for an answer. He was a stranger in the town. The operator refused to send the message unless the writer would deposit twenty-five cents to pay for the answer. The operator acted in obedience to a rule of the company that "transient persons sending messages which require answers must deposit an amount sufficient to pay for ten words."

The man sued the company to recover the statutory penalty for refusal to transmit a message. The question whether the company had any right to make the rule above quoted went to the Supreme Court of the State.

That tribunal sustains the company. It remarks that the right to make reasonable by-laws for the regulation of its own business is an inherent power of all corporations. The by-law in dispute in this case it holds to be reasonable. "A person," it says, "who sends another a message and asks an answer promises by fair and just implication to pay for transmitting the answer. The telegraph company has a right to proceed upon this natural inference, and in requiring a transient person to deposit the amount chargeable for an ordinary message it does no more than take reasonable measures for securing compensation for its own service."

How to Protect Jewelry Stores.

A remarkable series of electrical accidents occurred in this city last evening, says the Boston *Post* of Nov. 26. On the five-story building No. 604 Washington street, are a number of telegraph and electric light wires. By contact with these the metallic part of the building became charged with electricity. On the first floor is situated Morris' jewelry store, and in front of his show window is a long brass bar. About 6 o'clock, Elmer E. Morris, who is a clerk in the store, came in contact with some part of the building and was thrown violently through the open door into the street, receiving painful injuries. He was taken into the store, and while the other inmates were inspecting his injuries Mr. Frank McNish, of the theatrical combination of McNish, Slavin & Johnson, came along and stopped in front of the window. While he was looking at the jewelry he placed his hands on the brass bar. Before he could repent having done so he was drawn over the rail and could not let go. He was extricated from the painful position by patrolman Knight and a passer-by. While the officer was in the store with Mr. McNish, a young man, named William G. Tash, could not withstand the temptation of stopping and admiring the diamonds. He, too, allowed his hands to come in contact with the bright rail, and was instantly hurled across the street, a distance of about 60 feet. His injuries were such that a police ambulance was called, and he was taken to the City Hospital. Patrolman Knight then guarded the diamonds from observation as carefully as he would have guarded them from thieves, while a messenger was sent to the office of the Brush Electric Company for a man to uncharge the building. This was done, but none of the observers of the accidents could be induced to test the effect of the workman's remedies for some time afterward.

The Keely Motor Once More.

The directors of the Keely Motor Association met on Nov. 24 at the Lafayette Hotel, Philadelphia. Charles B. Collier, of New York, said: "In view of the many comments on the Keely motor, it was recently planned to submit Mr. Keely's discoveries and inventions to a party of unprejudiced men—men competent to judge and reliable in their statements, and who had no pecuniary interest therein. The following gentlemen have expressed their willingness to visit Mr. Keely's shop and pronounce upon the invention: Gen. Russell Thayer, Superintendent Fairmount Park; Mr. Sutherland Provost, Superintendent Transportation of Pennsylvania Railroad; Mr. Amzi Dodd, President Dodd's Express Company; Col. Richard Muckle; Richard Muckle, Jr., mechanical engineer; Theodore N. Vail, President American Telephone Company; and Theodore Ely, Superintendent Motive Power, Pennsylvania Railroad. The first application of his inventions in doing steady, practical work is soon to be made by replacing his small steam engine used in his shop with a small vibratory engine on the latest improved plan. Then is to follow the new and large 250 horse-power engine now in course of construction by Newsham & Co., of Philadelphia, which will be wholly vibratory (the present being only one-third vibratory and two-thirds pulsating), and Mr. Keely claims that with the contents of one receiver he will be able to run it continuously for 30 hours.

With this, Mr. Keely will cease his exhibitions, and, with all his patents secure, deliver to his company the entire apparatus, and their speedy manufacture will follow for the markets of the world." The day upon which the committee of gentlemen appointed will visit the Keely workshop will shortly be announced.

Induction Coil.

To the Editor of The Electrical World:

SIR: (1) I wish to make an induction coil to get a 1-inch spark. Will you please let me know through your paper the size of coil, the size of wire and how much fine wire it will take, and if (2) the bare wire woven the same as samples (inclosed) will do? If so, which is the best insulation? ELECTRIC.

MIDDLETOWN, Conn.

ANSWER.—1. Make your coil as follows (Sprague): Core, 6 in. long and 1 in. diameter; primary, 2 layers No. 16 gauge; secondary, 1 lb. No. 40 gauge wire; or, core 9 in. long and ¾ in. diameter; primary, 3 layers No. 16 gauge; secondary, 1 lb. No. 36 wire. 2. The silk insulation is better than the cotton, but the method of winding makes them useless for the purpose.—EDS. E. W.

The Use of the Name of Jenney.

To the Editor of The Electrical World:

SIR: Will those of your readers who have copies of the 1884 "Testimonials" of the Fort Wayne Company, after noting in the list of officers, "Charles D. Jenney, electrician," kindly turn to page 7, and they will find the following: "Not many men have accomplished more in a lifetime than the youthful Mr. Jenney has at the age of twenty years." Elsewhere they say that he has invented, thus far, the most perfect electric light. Yet Mr. R. T. McDonald writes you: "No such statement was ever made in any document issued by this (the Fort Wayne) company."

Asking your indulgence for burdening your columns with replies to such rash statements, I beg to submit whether it is not a singular spectacle—this trying to steal a man's name and crying "thief" because he seeks to keep it.

BRAINARD RORISON,
Sec'y Jenney Electric Co.

INDIANAPOLIS, Ind., Nov. 23, 1885.

Condensers in Telephony.

To the Editor of The Electrical World:

SIR: I have much pleasure in attesting the correctness of the statements of D. H. F. in your issue of Nov. 28, regarding the employment of condensers in telephony. His dates and descriptions are correct in every particular.

He, however, was not the first to point out the practicability of transmitting telephonic *signals* through condensers. I believe that Mr. George Black, of Hamilton, Ont., was the first to show this. I obtained the information directly from that gentleman late in the autumn of 1878, and put the idea into practice on the lines of the American District Telegraph Company in New York.

As is well known the lines of district companies are metallic circuits, and as many of the subscribers wanted telephones without special wires it was something of a problem how to afford telephone facilities, and yet refrain from increasing the resistance of the circuit.

To do this we used to attach a branch from the wire of the metallic circuit to one side of a small condenser, and an earthwire to the other side of the condenser; connecting the telephone in circuit either side of the condenser. It worked just as well when placed between the condenser and the ground, as it did between the condenser and the line, as might have been expected.

I don't mind telling the worst trouble that I experienced with this arrangement. It was that condensers so connected proved to be first-class lightning traps. Every little display of Nature's fireworks would find us in the possession of half a dozen damaged condensers.

The earliest printed information upon the subject that I know of, is comprised in the following patents: No. 212,373, February 18, 1878, Elisha Gray, which describes apparatus for simultaneously transmitting Morse and telephonic messages; the application for this patent was filed April 24, 1878; and the patent issued to George Black and Abner M. Rosebrugh on the same date, February 18, 1878, No. 212,433, which shows telegraph lines with earth branches divided by condensers in the way I have described, the telephone included in the earth branch.

The application for this patent was filed June 4, 1878.

THOS. D. LOCKWOOD.

BOSTON, Mass., Nov. 30.

Telephone Figures.

The Boston *Herald* of Nov. 25 publishes the following:

Bell telephone fell to 169 on moderate selling. The decline in the number of telephones in use is a possible cause for heaviness, and the assault on the validity of the chief patent a certain cause. Of the 3,750 instruments returned in the month ended Nov. 20, 2,458 were by the New England company, whose advance in telephone charges has caused subscribers to order out their instruments. As the last advance went into effect Nov. 15, most of the instruments to be ordered out have probably been returned. The net increase or decrease of telephones in use, as reported by the American Bell company for the months ended on the 20th, this year and last, is as follows:

	1885.	1884.
January	Dec. 298	Inc. 4,744
February	Dec. 594	Inc. 5,806
March	Inc. 60	Inc. 3,252
April	Inc. 1,691	Inc. 4,483
May	Inc. 2,442	Inc. 5,023
June	Inc. 2,411	Inc. 4,568
July	Dec. 314	Inc. 2,278
August	Dec. 544	Inc. 616
September	Inc. 169	Inc. 177
October	Dec. 1,051	Inc. 299
November	Dec. 1,416	Dec. 335
Net increase	2,556	30,911

New England telephone left Erie at 28 and pushed ahead to 30¼, a good September statement no doubt assisting. It is given below, in contrast with August, reduced construction and other expenses and increased gross receipts making an excellent comparative exhibit as under:

	September.	August	Since Jan. 1.
Receipts	$79,484.10	$77,366.84	$699,481.16
Expenses	53,041.91	60,583.66	501,024.10
Net	$26,442.19	$16,783.18	$198,457.06
Construction	2,216.75	7,404.23	67,003.59
Surplus	$24,225.44	$9,378.95	$131,453.47

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Nov. 30, 1885.

A large electric clock has been placed in the hall of the new building at the Institute of Technology.

The Sun Electric Light Company, of Woburn, Mass., has installed an incandescent plant in the large hall of the Mechanics Fair Building, this city, used by the Olympian Club as a skating rink. The lamps used were made at the factory of the Sun Electric Company, and give satisfaction in every respect.

The Consolidated Electric Light Company (Sawyer-Man system), through their New England agency have been given a contract for the installation of a 75 incandescent light plant on the premises of Messrs. W. S. Butler & Co., opposite the Fremont House, this city. A fifteen arc light plant is to be installed in the same establishment by the Thomson-Houston Electric Company.

The Jarvis Engineering Company, of this city, has sold another engine of the Armington & Sims make, of 90 h.p., to the Electric Light Company, of Bridgeport. The first-named company has completed the contract it had with the Narragansett Electric Light Company, of Providence, R. I., which included two six-foot steel boilers, set with Jarvis patent furnace, and six 50 h. p. Armington & Sims engines.

The long-talked-of Edison central station in this city for isolated incandescent lighting, although a certainty, has not yet assumed any tangible shape. The delay in the installation and equipping of the station is owing to the trouble experienced by the promoters of the enterprise in finding in a centrally located section of the city a building sufficiently large and otherwise suitable for purposes intended.

The Godfrey Seamless Pocket Co., Plymouth, Mass., have started up their new mill. The steam plant was furnished by the Jarvis Engineering Co., of Boston, and consists of a steel tubular boiler set with the Jarvis patent boiler setting, Sheffield grate bars, National heater, Davidson pump, Korting injector, etc. They use coal-yard screenings for fuel. One wheel of the engine runs the machinery of the mill and the other a dynamo of the Ball system. They use the lights in the mill and also run them out into the village to light the stores and streets. The installation is so successful that they now propose to add another engine to run more lights.

The *Commercial Bulletin* of Nov. 28 very truthfully says: The wretched quality of the gas in Boston is giving the gas fitters an unusual amount of work just now in cleansing clogged pipes and burners, and householders are anxiously praying for the time when electric light will be introduced for domestic use.

The Bridgeport Brass Co. are completing an elegant brick office, 43 by 45, two stories in height, which will afford them every convenience for the transaction of business. Without being extravagant, everything is in the most excellent taste. This company furnished the wire for the first long-distance telephone line, and make a specialty of electric wire. They are shipping insulated wire for electric lines to Norway, Germany, Mexico, South and Central America, and the bare enumeration of the countries shows how the use of the telephone is spreading.

The Windsor Locks Steel Company have a dual existence, the foundry being situate at Windsor Locks, Conn., as indicated by the name, while the wharf and office are at Bridgeport. The foundry was started in 1820 as the Ripley Iron Works, and after some changes took on the present name. They are now running twenty-two hours per day, with two gangs of men. Quite a proportion of their steel product is used in connection with electric lighting and gun making, to which they have added the rolling of tack plate. At Bridgeport they are handling large quantities of scrap iron, their yard being very complete, and their wharf a valuable one. Business is reported better than for some time past. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, Nov. 30, 1885.

The first successful public trial of the electric railway on Ridge avenue, in this city, was made on the evening of Nov. 28 in the presence of President Edwards, of the Ridge Avenue Passenger Railway Company, and a number of railway officials. A car was run over the road several times, making the trip without interruption, and attaining a speed of seven miles an hour.

As the eventful day (Jan. 1 next) approaches the city authorities roll up their sleeves and stand, pliers in hand, ready to cut all overhead wires in the city proper on that date. Meanwhile the telegraph companies—the Western Union in particular—go on erecting huge masts in the streets and stringing new aërial lines as usual. The city cannot bury its own wires in the time specified—the law includes *all* wires—and, moreover, has not appropriated enough money to pay for the grand carnival of wire-cutting. Superintendent Walker, of the Electrical Department, in his appropriation estimate for 1886, asked for $5,000 to "remove" the aërial lines in the city on Jan. 1, and the Finance Committee has awarded him $1,000. Now, in the old city proper—from Vine to South streets and between the two rivers—there are about 4,000 miles of wires, and it will be a hard task to cut the wires and remove them from the highways. By a recent decision of the courts the city is liable for damages from any accident occurring through its neglect to keep the streets clear, therefore the wires will have to be carried away at once and the $1,000 will not reach very far. So it is safe to say that there will be very little wire-cutting in Philadelphia on January 1, and that the local statesmen will see the injustice of demanding impossibilities, even from soulless corporations.

"The Pennsylvania and New Jersey Telephone Company" has been chartered at Harrisburg, with a capital of $1,000. It will do business in Lebanon, Berks, Schuylkill, Lehigh, Carbon and Monroe counties, Penna.

The Penn Mather Company have just finished fitting up the large silk mills of Alberts, at Scranton, Pa., with a 50-light machine, to be used instead of 60 kerosene lamps. They have also just closed a contract for putting 250 lights in Thron's Broad Street Garden, of this city.

R. K. Pearce, the electrical supply man, reports an increased demand for his goods and thinks the outlook in electrical matters is very promising.

The Ball Electric Light Company have a very complete plant at the corner of Cherry and Broad streets, in the Cyclorama building in this city. The light attracts large crowds and is considered a drawing card for the proprietors of this place of amusement. This plant is run by F. J. O'Brien and Winfield S. Lauer. E. F. I.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Nov. 28, 1885.

I have read with interest the observations of Mr. Chas. Lever on electric lighting in America. When in the United States Mr. Lever was a frequent caller at this office, and proved himself a diligent seeker of information concerning our system and methods, and a keen observer of the business as a whole. It should be remembered, however, that Mr. Lever is afflicted with a "system," and conclusions in regard to his observations should be tempered accordingly.

I was glad to see the WORLD recognize, editorially, the efforts of the Van Depoele Company in the direction of electrical railways. If I mistake not the record of this company will furnish a very good history of the progress of electrical railroading in the West, if not in the whole United States. It is one thing to *talk* electric railroads; it is another thing to *operate* them. The Van Depoele Company is *operating* them, and successfully too.

The next great boom in applied electricity will be in the direction of electrical railways.

New York ought to be pretty well posted in regard to Chicago's underground system. She has had our conduit men there to explain it to her officials, and she has sent a committee here to examine it. Now, if she is sensible, she will adopt it.

I find that the blow-pipe for soldering electric wires, illustrated in last week's WORLD, and manufactured by the Illinois Street Gas Company, is thought very highly of by electric light companies. It seems to be "just the thing."

I have advised you from time to time of the progress of the work of the United States Company, in filling its heavy contract for the lighting of the Cook County court-house building. The work is now finished. The details of the electrical part of the work have been accomplished under the direction of Mr. F. B. Badt, who, as an assistant to Mr. C. C. Warren, the manager of the western department of the United States Electric Lighting Company, has made a record of which he may well be proud.

Mr. Charles C. Warren, the western manager, has by his unbounded energy and perseverance, combined with high executive skill and judgment, created a business that in its extent and in the pecuniary interests involved is a credit to the company he so ably represents. In giving me the details of the work, Mr. Warren says:

"The architect who planned and the board of county commissioners who assisted in the construction of the Cook County court-house building seemed to be possessed of the happy thought that daylight was a deadly enemy to mankind, and the most effectual means of preventing its ingress must be adopted. That they succeeded admirably all who have had business to transact within the gloomy walls of that structure will bear witness. Some evil-minded persons have fancied that it was a conspiracy between these individuals and the gas companies. These honorable gentlemen have all had their names carved in granite, which are placed in the foundation stones of one of the porticos of the noble building. They are on the east side, where the sun, before it became tired in its struggle with the smoke-consuming ordinance, could manage to get some of its rays through the murky clouds and shine upon the names of these immortal personages.

"Subsequent commissioners disagreed with their predecessors, and concluded that the interminable smoke of the sickly gas-jets was not conducive to the beauty of the internal architecture, and that some regard, furthermore, to the sanitary conditions should be respected. They have, during the past three or four years, attempted at different times to inaugurate a better means of illumination. At several different times proposals have been solicited for lighting the court-house with electricity. Finally, however, in the early part of the present year, the commissioners decided that the plans of their predecessors were not in accordance with the modern idea, and determined that some better means of illumination should be adopted. Investigations once commenced looking toward the adoption of electricity as an illuminant, the idea occurred to them that it might possibly be well to adopt the measure in all of the county buildings. Proposals were asked for and were submitted by the two companies able to install incandescent lights, and the result was that the proposal of the United States Electric Lighting Company was accepted about the early part of July. A committee for the county commissioners investigated the two different systems and were unanimous in the adoption of the one to whom the contract was let.

"When making the contract with the United States Electric Lighting Company, it was for the installation of about 3,700 incandescent lights in the five different buildings of Cook County—namely, the Cook County court-house, a large power plant with four dynamos sufficient to operate

about 1,800 lights; power plant, shafting, pulleys and dynamos for operating nearly 1,400 lights at the county hospital; a power plant and lamps for operating about 400 lights at the criminal court-house and jail; power and dynamos for operating about 400 lights at the insane asylum; and for the infirmary, engines, boiler and dynamos for operating 250 lights.

"The undertaking was one that scarcely any other electric lighting company could have carried out successfully. Furthermore, it was begun by the United States Company when they had a vast amount of other work on hand. Work was commenced on the 14th of August. Contracts for engines, boilers, steam fitting, etc., had all to be entered into. Engines had to be built especially for the work. Great quantities of fittings were required specially adapted and manufactured, and all put into complete and perfect operation, and the different plants were practically finished before the middle of the present month. Some delays, however, were experienced in the power plant at the court-house, which prevented starting as early as anticipated. The plants at the other buildings were practically finished during the early part of the month, and were all started and tested and found correct in every particular.

"On the 19th inst. steam was turned into the engine at the court-house, and as soon as it came to its proper speed every inch of the fifty or sixty miles of wire throughout the immense building was properly charged with the electric current generated by the four dynamos in the engine-room, and every light, with the exception of possibly a dozen, immediately came up to its standard sixteen candle-power light, completely changing the aspect of the building from that of the most sombre gloom to one of dazzling brightness. It is quite doubtful if such a result has ever been attained by any other electric lighting company, and it is, of course, gratifying to the commissioners to know that their expectations have been fully realized, and furthermore to know that their expenditure of the public money has been so wisely made. A comparison of the cost of these five separate plants, aggregating 3,700 lamps, with the plant in the City Hall, consisting of two engines, four dynamos, 1,200 lamps, may not be out of place, the last-named plant costing the city $41,375, while the five county plants more than three times that furnished the city, cost the county less than $80,000, about $26,000 being the portion of the expenditure that the court-house should bear for a plant as large as that in the City Hall.

"Besides this, the county has a system that produces ten lamps of sixteen-candle power for every horse-power, against the city's plant that develops only six and a half or seven lamps for a horse-power." W. A. K.

EVANSVILLE, Ind., Nov. 27, 1885.

I have just returned from a visit to Owensboro, Ky. That beautiful little city looks bright and cheerful at night, as the streets, stores and saloons are lit by the electric light. The Electric Light Company furnish the city 20 arc lamps, of 2,000 candle power. They have now in use 3 towers with 4 lamps each, 5 bridges with one lamp in the middle of each bridge, 2 lamps on the dome of the Court House and one mast on the wharf. The latter light, aided by one in front of the skating rink on Water street, makes the wharf nearly as light as day. Passengers getting on or off boats can see their way clearly. The city pays $2,500 per annum for the 20 arc lamps.

In addition to the city lights, 40 arc and 14 incandescent are furnished to private parties.

The company owns a brick building, two 50 horse-power engines, one 45, one 30 arc and one 150 incandescent dynamos.

J. W. Porter, general manager of the company, is a young man of pluck and energy. He says their prospects are very flattering, so much so that he has employed a first-class operator to do the work in the Owensboro and Evansville telegraph office. Porter is owner and manager of that line and a large stockholder in the Electric Light Company, the success of which is due to his energy and hard work. I left him putting up lamps with his own hands. N. M. BOOTH.

THE TELEGRAPH.

Saved by the Cable.—William Roder, who is said to keep a house of ill-fame in this city, was arrested at Castle Garden on Nov. 27, charged with bringing women into the country for illegal purposes, and held in $5,000 bail. Roder brought with him on the steamer "Rhein" two 18-year-old girls named Winter and Sauer, whom he had allured from their homes in Hesse-Darmstadt. The arrest was caused by a cablegram from Miss Winter's mother.

Postal Lines to be Sold.—A dispatch of Nov. 27 from Baltimore says: In the Circuit Court, to-day, Judge Fisher filed an opinion in the case of Day against The Postal Telegraph Company. The Judge says that, while the Postal Telegraph Company of Baltimore is a corporation, the Receivers have the right to demand and collect the debt due by it to the New York company. Judge Fisher passed an order to sell all the property of the Postal Telegraph and Cable Company.

The B. & O. in the South.—President Bates, of the Baltimore & Ohio Telegraph Company, received a dispatch from New Orleans, saying that the Supreme Court of Louisiana had affirmed the judgment of the lower court in the case of the Baltimore & Ohio Company against Morgan's Louisiana & Texas Railroad Company, in which the Baltimore Company sought to build its telegraph lines between New Orleans and Lafayette, La., a distance of 144 miles, on the right of way of the railroad company. The line has been in operation since Jan. 1, 1885. The Western Union's motion to remove the case to the Federal court was denied.

Southern Extension.—The Arkansas Telegraph Company, a branch of the Baltimore & Ohio system, has resumed work with a full force of men, erecting its line from Little Rock to Malvern, along the line of the St. Louis, Iron Mountain & Southern Railway. Recently a force of railway men tore down the poles as fast as the telegraph men erected them. The telegraph company filed a complaint in the Chancery Court praying for a restraining order against the railroad company. On Nov. 25 the court granted the injunction asked for and made it perpetual. The railroad company appealed to the Supreme Court and the telegraph company resumed work.

Property Valuation.—At Poughkeepsie, N. Y., on Nov. 30, the valuation and taxation of the property of telegraph companies in towns throughout the State was a question brought up in the Dutchess County Board of Supervisors, and a member of the board has submitted a statement showing that in nearly every case the valuation of the property of the different companies has by law been left to the companies themselves, thus taking the entire matter out of the hands of the local assessors in each town. It is proposed to have an amendment to the law framed, giving the power of valuing the property in each town to the local assessors, and a copy of the amendment will be sent to each board of supervisors in the State, with a request for co-operation in endeavors to get the bill through the coming Legislature.

Western Litigation.—At Chicago, on Nov. 28, Charles W. Brega and James M. Ball filed a long bill in the Circuit Court against the Board of Trade Telegraph Company, E. S. Stokes, C. H. Read, Dwight Townsend, A. W. Dimock and Richard Newcombe, asking for the appointment of a receiver for the company. The company was organized in 1881 with a capital stock of $750,000, and in October, 1882, it issued $50,000 of bonds secured by all its property. In February, 1884, all the company's lines were leased for 99 years to the Bankers and Merchants' Telegraph Company. The last named company is bankrupt, and L. D. Parker, who was appointed Receiver by Judge Blodgett, has since been operating both lines. Under the foreclosure sale in New York of the Bankers and Merchants', E. S. Stokes acquired a majority of the stock of the Board of Trade Telegraph Company. Stokes is President of the United Lines Telegraph Company, and he is trying to get possession of the Board of Trade Company's lines to make them part of his system. A petition has been presented to Judge Blodgett by the Stokes faction asking that the Bankers and Merchants' Company be compelled to turn over to them the property of the Board of Trade Company, and an entry has been made to that effect. The complainants ask for a receiver and also for an injunction to prevent any incumbrance of the lines, or the issue of any bonds, or the making of any lease.

THE TELEPHONE.

Is That So?—A Washington stove dealer invented a house telephone, a simple little contrivance, making use of gas and water pipes instead of wires, attached to which in each room was a transmitter and receiver. But he was informed that his machine was an infringement of the Bell, though he used no electrical current, and he abandoned his intention of making a business of furnishing these instruments in houses.

On the Pacific Slope.—The case of the Gold and Silver Telephone Company vs. the Pacific Bell Telephone Company was submitted to Judge Hunt, San Francisco, October 2d, and on the 9th inst. the demurrer was overruled, with ten days to answer. Subsequently Judge Hunt set aside his order and the attorney for the defendant was allowed time to file brief. The time having expired and no brief having been filed, the demurrer was again overruled.

Long-Distance Telephone.—A long-distance transmitter is being tested in the local office of the Wisconsin Telephone Company, the same used in the attempt to converse between Chicago and New York. By using the new transmitter a whisper can be heard a distance of 250 miles with the same distinctness that it can by a person in the same room. The telephone company has made a requisition for a number of the instruments, and they will be used on all of the long-distance lines.—*Milwaukee Journal.*

Proud Petrolea.—Petrolea stands away ahead of any town in Canada, says the Petrolea *Topic*, of equal population in the use of the Bell telephone. The exchange here opened with more instruments than any other agency ever opened in the Dominion by the company, and through the popularity and energy of the manager here, Mr. W. G. Fraser, and the highly satisfactory way in which the exchange has been conducted, the number of subscribers has steadily increased. Last week three new instruments were put in. This makes eighty-nine instruments in all.

The Lowell Telephone Syndicate.—An item from Lowell, Mass., under date of Nov. 27, says: "A mortgage was taken on the household furniture of Loren N. Downs for $3,100 on Wednesday by Charles J. Glidden. Both of these gentlemen are in the telephone syndicate, and it is a matter of speculation whether this mortgage was given to raise money or to provide against any more attachments. The property of the telephone syndicate is so covered with attachments in suits now pending that the members cannot realize one dollar in income, everything being covered.

French Telephone Statistics.—The number of subscribers to the Société Générale des Telephones already exceeds 6,000. On the 12th inst. the actual number was 6,001, against 5,464 in the preceding year. In Paris the Société have 3,969 subscribers, served by 170 telephonists. The number of communications exchanged in that city varies between 25,000 and 30,000 daily. The mail steamer "La Normandie," belonging to the Compagnie Générale Transatlantique, has received a very complete telephone installation, carried out principally with a view to affording rapid communication between the decks, etc., and the engine rooms.

Contracts by Telephone.—A somewhat novel point in insurance law has just been decided in Cincinnati, where, in the case of the Tacoma Packet Company *vs.* the Eureka Insurance Company, tried before Judge Sage, the jury returned a verdict for the full amount of the policy ($2,500) upon which the suit was brought with interest. The steamer W. P. Thompson was insured by the defendant company, and it was claimed by the plaintiffs that an agreement was made by telephone extending the privilege to the Mississippi River. The court held that if the defendants were in the habit of receiving insurance by telephone, a message to a clerk which the company knew had been received would bind it unless there was express dissent thereto.

Drawbaugh Again.—At Syracuse, N. Y., on Nov. 28, Judge Wallace, in the United States Court, heard the presentation of additional evidence in the case of the American Bell Telephone Company vs. The People's Telephone Company et al. The case practically resolves itself into the question whether the electric speaking telephone was first invented by A. G. Bell or by Daniel Drawbaugh, of Milltown, Pa. By a recent opinion handed down by Judge Wallace the Bell patents were allowed to stand, but the judge expressed some doubts on certain points, and this hearing is by a stipulation to reopen the case for the introduction of additional evidence on these points. The plaintiffs were represented by J. J. Storer, of Boston, and E. N. Dickerson, and the defense by Judge Hill, of Chicago, P. C. Chandler and Henry C. Andrews.

Not a Sectional Issue.—Our contemporary, the *Tribune*, prints this paragraph in its nonsense column: "The speculative geniuses at the uptown pool-rooms are offering three to one that Secretary Lamar will open up the questions of the validity of the Bell patents. The way they reason is that the South is in the saddle and it will ride, in this as in other matters where Southern men are interested against Northern men." This is another exemplification of the *Tribune's* mistaken policy of creating distrust and ill-feeling between the sections. Why should Secretary Lamar unjustly disturb the Bell Telephone people? Simply because they are Northern men? This may be the estimate of Southern statesmen in the *Tribune* office, but what is this prejudice based upon? The Southern States are filled with Northern men and Northern capitalists. These men certainly find as much justice and fair dealing in the South as Southern men find in the North. What is to be gained by the insinuations which the *Tribune* is so fond of throwing off in its careless way affecting the integrity and honesty of Southern people? Nothing, we presume, save a prolongation of sectional hate.—*New York World.*

THE ELECTRIC LIGHT.

Decatur, Ill.—The city of Decatur has contracted for the Jenney electric light, at a cost of $16,500. Eight towers, each 125 feet high, will be built, and ten lower ones.

Illinois.—The South Chicago Gas and Electric Light Company has been incorporated under the general laws of Illinois. The Lemont Gas and Electric Light Company, of Lemont, has been organized, but will not begin operations until spring.

Rahway, N. J.—The Tesla Electric Light Company, which has been experimenting and perfecting its new light, is nearly ready for business, and has contracted to light with electricity the buildings of Taylor & Bloodgood. It will also illuminate the building in which the great fair to be given by Barry Post G. A. R. is to take place.

Alas, Too True!—Can the insinuation of the New York ELECTRICAL WORLD be true that the bitter attack recently made by the virtuous *Scientific American* on electric lighting is due to the fact that our scientific contemporary had vainly solicited advertisements of electric lighting companies? The strictures of the *Scientific American* are certainly strange reading after its illustrated reviews of the different systems about a twelvemonth ago, but our opinion of the impartiality of the press forbids us to accept the suggestions of our electrical contemporary.—*London Invention.*

The Schuyler System.—The Schuyler Electric Light Company started its first central lighting station in Holyoke in August, 1884, with 30 lights, and now it has 170. Since then they have introduced their system into Chicago, Ill.; Allentown, Columbia and Pottstown, Pa.; Knoxville, Tenn.; Danbury, Middletown and New Britain, Conn.; Skowhegan, Me.; Marlboro, Mass.; Elizabeth, N. J.; and Richmond, Va. All of these are arc lights. Their incandescent lights for general use are in the building of the Connecticut Mutual Life Insurance Company and other important places. They employ 150 men and have the entire building formerly occupied by the Hartford Engineering Company.

San Francisco, Cal.—At a meeting of the Street-light Committee of the Board of Supervisors, on Nov. 18, three electric light companies asked for a franchise to erect poles, wires and other necessary appliances for using electricity for lighting and other purposes, on, over and under the streets of the city. They were the Pacific Coast Electrical Construction Company, which claimed consideration from the fact that all its machinery would be made in the city, and thus help trade; the San Francisco Condict Electric Light Company, represented by Mr. McGrew, which proposes to lay all wires underground, and the Pacific Thomson-Houston Electric Light and Power Company. Mr. Farnsworth stated that action in these matters had been delayed by the Street Committee to await the investigations of Mr. Ladd, who had gone East to examine plans for laying wires underground. After some remarks from Gas Inspector E. P. McCarthy relative to certain proposals by a Chicago company, the matter was, on motion, laid over for two weeks. Clerk Russell read a communication from Alexander Graham Bell, of the Bell Telephone Company, strongly indorsing the laying of telephone wires underground, and recommending that legislative action be taken to compel companies to adopt that system.

PERSONALS.

Dr. Norvin Green.—It is said that Dr. Green bought recently the Ford family homestead at Louisville, Ky. One of these days he may spend a well-earned leisure there, but he is a man whom office seeks, though he would prefer to retire. He is now well-off and would make a good "founder of a family" had not his ancestors saved him the trouble.

A Generous Gift.—The firm of J. H Bunnell & Co. has shown a large and timely generosity in giving the handsome sum of $200 towards the relief of operators who lost their homes in the late fire at Galveston, Tex. This recalls the fact that during the Cincinnati floods, the firm also came forward in a very generous way, and contributed no less than $250 in aid of the telegraphic fraternity in that city.

Notable Longevity.—At the wedding in Troy week before last of Joseph A. Powers, general manager of the Troy Electric Light Company, and Miss Emma J. Tibbits, there were present Mrs. Martha Waters, aged ninety-six, grandmother of the bride, and Mrs. Deborah Powers, aged ninety-five, grandmother of the bridegroom. Mrs. Deborah Powers is the head of the banking firm of D. Powers & Son, and is the oldest woman banker in America.

MISCELLANEOUS NOTES.

Electrolysis of Salts.—In a paper recently read before the Academie des Sciences, M. Renard stated that in solutions sufficiently dilute the amount of metal precipitated is proportional to the concentration of the liquid. The proportions of metal deposited are in the same relation as their atomic weights. According to the law of Faraday

the quantity of metal precipitated being proportional to the intensity of the current, the conductivity of solutions containing equivalent atomic weights of metal is the same, as M. Bouty has sufficiently demonstrated.

The American Exhibition in London.—John R. Whitley, of London, and John G. Speed, of New York, Director General and Secretary respectively of the American Exhibition to be held in London next year, arrived in Washington last week to attend to some of the details of the work connected with the exhibition. Mr. Whitley had an interview with the President. He requested that the President should open the exhibition by telegraph on May 1 next, and, by touching a button in Washington, put the machinery in motion in London. The President readily assented, and arrangements will be made next spring so that this may be done.

An Important Modification.—Mr. C. M. Gavill has presented to the Physical Society, in the name of Mr. Guerin, says the London *Electrician*, a cell whose liquids have been rendered immovable, and which is as a consequence portable. This result has been obtained by substituting for water a solution of agar-agar, an alga that comes from the far East. The liquid upon cooling becomes a solid and elastic jelly. The proportion of agar-agar may vary from one to five per cent., and depends upon the substances that are to be mixed with liquid. The model that Mr. Guerin has studied is the agglomerate Lelanché. Its electromotive force is slightly less (0.03 to 0.04 volt) than that of the ordinary styles of the pile. The resistance of one of these elements of medium dimensions is about 0.09 ohm. The same process may be applied to any other primary cell.

A Mean Scamp.—Joseph J. Hellehan was arrested in Boston, Mass., last month, by Inspectors Mahoney and Burke on a charge of obtaining money under false pretences in connection with a so-called Institute of Telegraphy which he was running. Among his victims was Nellie Finnegan, of Swampscott, $25. To Miss Finnegan he pretended that his school is a regular telegraph office, and that the wires are connected with the offices of the principal railroads in Boston, and that 600 of his pupils are now holding good positions. She claims that she gave Hellehan $10 for him to purchase a season ticket on the railroad from Swampscott, but that instead of doing so he bought her a monthly ticket that was only worth $3.40. She asked him to give her either the season ticket or the balance of the money, but he refused to do so, she alleges, until she gave him $15 more for learning the business. This gentleman has been exposed before.

BUSINESS NOTICES.

[Copy.]

W. H. GESNER, SUP'T.

OFFICE OF
THE BRUSH ELECTRIC LIGHT AND POWER CO.,
MONTGOMERY, Ala., Nov. 17, 1885.

Messrs. Giles Bro. & Co., State and Washington Streets, Chicago, Ill.

DEAR SIRS: I have to acknowledge receipt of my watch with magnetic shield. Please accept my thanks.

I have given the watch a thorough test—held it all about the field magnets of a No. 8 Brush machine, running at 750 rev. per minute and supplying 52 arc lamps, without visible effect.

I consider your magnetic shield a perfect protection from magnetism.

I have ruined three or four watches heretofore, and have spent money enough for repairs to buy a dozen shields almost. Very truly yours,

W. H. GESNER, Sup't.

Adjustable Pocket Wrench.—The Billings & Spencer Company, of Hartford, Conn., make a very handy and neat pocket wrench, four, five or six-inch drop, forged from bar steel. This new five-inch wrench meets a want. It opens 1¼ inches, and is graduated on the bar to thirty-seconds of an inch. The 4-inch and 5-inch wrenches are designed for bicycles and tricycles, the 6-inch for machinists, tool-makers and all others requiring that size.

Mechanical Telephone Exchange.—A decided novelty in the field of acoustic telephony is now in active development by the Consolidated Telephone Company, of Jersey City, N. J. The details, both of the telephone and the exchange system, have been very successfully worked out, and we hope to give them in detail in an early issue.

Belts Giving Excellent Service.—The following card bestows a deserved encomium:

THE EDISON COMPANY, FOR ISOLATED LIGHTING.
GENERAL SUPERINTENDENT'S OFFICE,
65 Fifth Ave, Room No. 11.
NEW YORK, Nov. 14th, 1885.

Chas. A. Schieren & Co., Ferry and Cliff Streets, New York City:

GENTLEMEN: We have used several of your special Electric Light Belts. They are very pliable, they do not rip, and do not stretch. They have given us excellent service wherever used.

Yours truly, J. H. VAIL, Gen'l Supt.

Hill's Hair and Whisker Dye

Colors to any natural shade of black or brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure; 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 67; Am. Dist., b 26½, a 28½; B. & M., b 4½, a 5½; Western Union, b 76½, a 76¾.

Telephone.—Am. Bell, b 166, a 167; Erie, b 27½; New England, b 29.

Electric Light.—The *Miscellaneous Security Report* of Nov. 24 says: Electric light company shares are in more demand. Edison Parent Company has advanced to $100, Daft to $110, while for nearly all the other stocks there is more inquiry. The electric light companies have now got to a point where they will soon begin to yield dividends—the parent companies may pay big ones and the sub-companies can be counted on for good ones.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED NOVEMBER 10, 1885.

Printing Telegraph; Clarence L. Healy, Brooklyn. Assignor to Stephen D. Field, Yonkers, N. Y..... 330,238

Consists in arranging in the key of a printing telegraph an electro-magnet so arranged that upon the circuit being closed, such magnet will act to cut out or short circuit the key, and by holding this circuit closed independently of the key will lock the transmitter and hold the press circuit relays down the requisite length of time to insure the proper action of the press mechanism, and will then open the key and press circuits and release the transmitter.

Transmitter for Printing Telegraphs; Clarence L. Healy, Brooklyn, Assignor to Stephen D. Field, Yonkers, N. Y..... 330,239

Consists in the use of a dash-pot-cushioning device in connection with the mechanism that is used to arrest the shaft operating the commutator, the effect of the cushion being to take up the shock that is produced by the impact of the arresting device upon the revolving parts without causing any back-action, and thereby protect the other parts of the mechanism from undue strain and vibration.

Regulator for Electric Lights; Phillip Lange, New York, N. Y., Assignor to Bergmann & Co., of same place..... 330,244

Consists in the use of two or more sets of resistance-coils, each having an independent commutator, both or all said commuutators being worked by the same turning-lever or hand-wheel, whereby the different sets of resistance coils are thrown into various arrangements of multiple-arc series and multiple series to vary the resistance of the circuit. The commutator-arms are so arranged that the movement of the common shaft causes those of the different sets to act successively, one after another, so that one set of resistances is partly changed, then the same change occurs in the next set, and so on.

Electrolytical Carbon Electrode; Henry Liepmann, London, England..... 330,247

It is composed of a number of carbon rods or pieces, and a filling between them of carbon material baked therein, the ends of said rods being insulated.

Telegraph Instrument; George W. Stewart, New York, N. Y., Assignor of one-half to Stephen J. Cox, of same place..... 330,271

Consists in providing the casing with an aperture over the end of the sounder opposite the armature, and in providing that end of the sounder with an upwardly-projecting point arranged and adapted to pass upward and downward in the aperture of the casing sufficiently to strike against the operator's finger when placed upon and over the aperture, as that end of the sounder is connected to the armature.

Automatic Perforating Telegraphs; James E. Munson, New York, N. Y..... 330,344

Consists of two instruments—a transmitter at the sending-station and a reproducer at the receiving-station—the two being located in an electric circuit and made to operate synchronically. When it is desired to capacitate the apparatus to transmit and reproduce at both ends of the line, the two instruments will be exact duplicates; but when it is desired to transmit in one direction only, the feeding mechanism of the two will be slightly different, and the reproducer alone will be provided with a perforating mechanism.

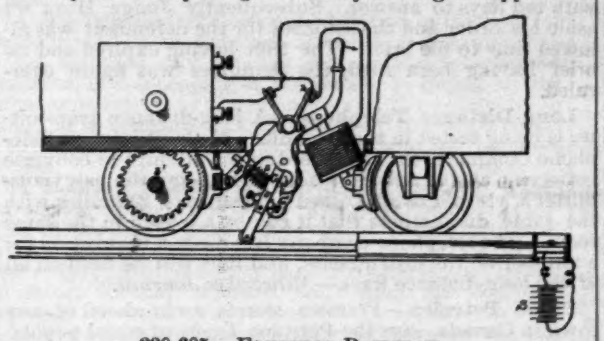
Arc Lamp; Otto Romanze, Tousley Hill, England, Assignor to Mason & Co., London, England..... 330,351

Consists of a tubular soft-iron core, through which the upper carbon passes, provided with guide rollers to hold the carbon, and of automatic feed mechanism consisting of a pressing-roller mounted in a frame pivoted to the core and pressed against the carbon by springs, and of an escapement and pendulum controlling the revolution of the said roller and a spring-detent for arresting its motion, whereby the feeding of the upper carbon is effected and governed.

PATENTS DATED NOVEMBER 17, 1885.

Telephone System; Robert P. Barbier, Paris, France..... 330,368

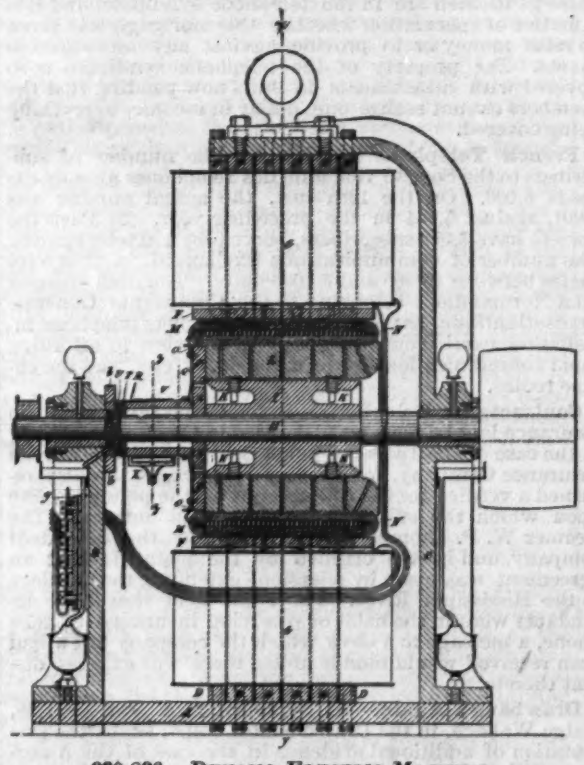
In a system comprising a battery and signal apparatus at a central station there are circuits extending from the battery to one or more sub-stations, and push-buttons at said stations, and a telephone at the sub-station in a branch derived from the push-button circuit.



330,605.—ELECTRIC RAILWAY.

Dynamo Armature; Marmaduke M. M. Slattery, New York, N. Y., Assignor by direct and mesne assignments to the Sun Electric & Illuminating Company, Manchester, N. H..... 330,433

Semicircular plates covered with insulating substance are secured and are disposed along a shaft.



330,836.—DYNAMO ELECTRIC MACHINE.

Electrical Devices; Harold P. Brown, Chicago, Ill..... 330,463, 330,464, 330,465, 330,466

The first is an electro-magnet in which the ordinary retractile spring is replaced by a weight suspended by one cord from the armature and by another cord from a distant point. In the second he arranges the circuit so that only one resistance is adapted to take the place of any one of a multiple number of lamps. The third consists in a peculiar application of a dash-pot in a device for controlling a variable resistance in a shunt to incandescent electric lamps. The fourth consists of a fixed contact and multiple movable contacts, and a slide or cam connected therewith.

Lightning Arrester; Arthur J. Holt, Cleveland, O..... 330,486

Adjacent to a line wire provided with a plate having numerous points is a second similar plate connected with earth to carry off an abnormal charge.

Dynamo Armature; Charles D. Jenney, Indianapolis, Ind..... 330,490

Consists of a shaft, spiders mounted thereon, having lugs upon the outer ends of their arms, holes in said lugs, the armature body bolts passing through said body and said holes in said lugs on the arms of said spiders, and insulating material placed around said lugs and between them and said bolts.

Induction Coil; Joseph C. Vetter, New York, N. Y..... 330,531

Consists of details of construction adapted for convenience of use in medical purposes.

Filament; Charles Heisler, St. Louis, Mo..... 330,586

It is made from braided material.

Electric Railway; James F. McLaughlin, Philadelphia, Pa., Assignor, by mesne assignments, to the National Electric Railway System, of same place..... 330,605

As shown in the cut, it consists of a motor-car of an electrical railway, provided with a motor and car-brakes, and a single lever having connection with both the motor and brakes, to throw one out of action when the other is thrown into action.

Telegraph Sounder; George W. Stewart, New York, N. Y., Assignor of one-half to Stephen J. Cox, of same place..... 330,635

Consists in a sounding bar or lever attached to the armature and having C-shaped jaws at one end, and at its other end a pin or touch-point.

Switch-Board; Theodore N. Vail, Boston, Mass., Assignor to the American Bell Telephone Co., same place..... 330,644

Consists in the use of wires stretched tight alone, in lieu of any other connection plates whatsoever, in the combination, with such wires, of suitable stretching and straining devices, and in dispensing altogether with the alternating non-conducting plates, using in lieu thereof a space of dry air only.

Telephonic Circuit and Apparatus; John B. Wood, Montreal, Quebec, Canada..... 330,763

By this invention a person at one station can call and place himself in connection and converse with any one or more of the other stations in the system without cutting in or disturbing the remainder. To this end he has a separate line running from each station to each one of the others, and each station is provided with a call-bell, a transmitting and receiving instrument and a case containing electro-magnets, armatures and connecting drop-levers in number to correspond with the number of stations in the system, and push-buttons numbered to agree with the station numbers, each of which, when pressed, will operate to release one of the drop-levers and throw the required line into circuit.

Dynamo; Oscar F. Jönsson, Stockholm, Sweden. 330,836

Consists of two brackets, *B* and *C*, fixed on a base *A*, of which the latter is at the top bent to an angle in order to retain the electro-magnets. The latter are composed of a number of curved iron bars *D*, preferably of wrought-iron attached some to the bottom plate and some beneath the bracket *C*. These bars are connected by means of two bent pieces *E*, of iron, forming the pole-pieces and receiving contrary polarity. *F* are non-magnetic metallic plates interposed between the ends of the bars *D* and screwed to the pieces *E*, in order to keep them stayed. The electro-magnet coils *G* are, as will be seen, applied round the legs of the bars *D*, whereby four such coils are obtained.